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COMMUNICATIONS

HERPES ZOSTER OPHTHALMICUS

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HERPES zoster ophthalmicus is a painful condition which produces a rash on some of the skin supplied by the first division of the fifth cranial nerve. Ocular complications or sequelae arise in approximately one-half of the cases. The epidemic form is caused by an acute infection involving part of the Gasserian ganglion and fifth cranial nerve on one side, and is analogous to herpes zoster occurring elsewhere in the body. Symptomatic herpes zoster is usually unilateral, but, unlike the epidemic variety, may be bilateral. It is associated with toxic, inflammatory, or neoplastic damage implicating the fifth cranial nerve, the Gasserian ganglion, or any of those fibres that constitute the central connections of the nerve. Therefore it may occur at any age. This symptomatic form cannot definitely be diagnosed as such, unless the patient presents evidence of some causal lesion, *e.g.*, syphilis of the basal meninges, or cerebral tumour. In most cases the evidence is sooner or later available, but may remain latent until several months after the herpetic eruption has subsided. The following description is intended to refer chiefly to the epidemic form of the disease.

Most of the sufferers are middle-aged or elderly. The literature does indeed contain instances of the disease occurring in early

childhood, but some of these cases were probably examples of the symptomatic variety, wherein the essential cause of the trouble had not yet become manifest. Preponderance on the part of either sex does not appear to have been proved. One observer will quote a long series of cases in which females are easily outnumbered. Another will find that his experience has been in this sense directly opposite. It seems clear that epidemic herpes zoster ophthalmicus is almost equally common among males and females. The epidemic nature of the disease is shown by the occurrence of a number of cases simultaneously, although it must be far less infectious than most of the zymotic diseases. I do not know any example of ophthalmic zoster visiting two people in the same household. Trousseau, however, saw thoracic zoster in an old woman living with her son, on whose chest a similar eruption arose during his mother's convalescence. Second attacks are extremely rare. Further support for the use of the term epidemic is provided by the sudden onset, accompanied by fever and prostration.

Clinical Course.—These are the three principal features:—

(1) Pain along the course of distribution of the first division of the fifth cranial nerve.

(2) A skin rash appearing about three days later on a portion of the corresponding area of the face or head.

(3) Limitation of the rash to one side.

At the time of onset the characteristic distribution of the neuralgic pain may be masked by symptoms of acute discomfort all over the body. Thus there may be nausea, rigors, generalised headache, and abdominal pain culminating in vomiting. The temperature is nearly always raised. Within a few hours all these accessory symptoms are overshadowed by the distinctive zoster neuralgia. Mild cases are seldom seen, in which sensations merely of numbness and tingling are felt in the areas concerned. More often there is severe burning and throbbing pain shooting up from the forehead towards the back of the scalp, and associated with exquisite tenderness of the skin in those regions. This pain, enduring without intermission, as it often does, for two weeks or more, seriously interferes with sleep, and has been vividly described by numerous writers. Thus an editorial note in the *British Medical Journal,* 1866, Vol. I, p. 470, says: ". . . . A man need wish his worst enemy no worse week's or fourteen day's excitement than an attack of it [Herpes zoster of the head and face] . . .." Many of the older patients become dangerously exhausted after long, successive days of uninterrupted agony. I have seen one instance of fatal collapse attributable to this cause.

Jeffries reported the death of an old lady at the end of six weeks' herpetic neuralgia of the head and face.

The skin eruption, which appears several days later, is associated with intense redness and swelling of the affected area, so that it has often been mistaken for erysipelas, a disease whose favourite site is the upper part of the face. The fact that both conditions produce vesicles helps further to explain their confusion with each other. Nevertheless, such an error in diagnosis would be unlikely to be committed by anybody to whom a genuine case of herpes zoster ophthalmicus had once been demonstrated. The extent of the rash is usually proportional to the severity of the attack. Of the three main branches—lacrymal, frontal, and naso-ciliary—into which the first division of the fifth cranial nerve divides, the frontal never escapes, so that some spots always appear over the upper orbital margin, forehead, or scalp. When the forehead eruption has been remarkably severe, I have twice seen it transgress the middle line by more than an inch. This phenomenon presumably depends on overlapping of the fibres from the two different sides, and need imply no essential contradiction of the rule that epidemic herpes zoster ophthalmicus is a unilateral disease.

Rupture of the vesicles occurs soon after the outbreak of the rash. Their liquid contents gradually become dried up to form scabs which, on separating, leave permanent marks in the shape of small, pitted scars. Healing is usually established within three weeks of the original eruption, unless the issue is complicated by sepsis. In many cases the lacrymal and naso-ciliary nerves are involved, and spots may be seen on the skin of the eyelids, or on the side of the nose. Occasionally the conjunctival surface of the lids is attacked. Simultaneous partial involvement of the second division of the fifth nerve has been seen. One of Hutchinson's cases, an elderly man who displayed the rash on his forehead, nose, eyelids, and cheek as far down as the upper lip, disproved that observer's previous statement that the cheek always escapes. Another patient of Hutchinson's, suffering from right-sided zoster in the area of distribution of the fourth dorsal nerve, developed left ophthalmic zoster one day later.

Detailed examination of the eye during the eruptive stage is rendered difficult by tenderness and brawny swelling of the eyelids, more especially of the upper one. Some degree of conjunctivitis is invariably present, and is often aggravated by staphylococcal invasion from the adjacent skin-lesions. In such cases the homolateral preauricular lymph-gland is often enlarged. Whenever the state of the eyelids has allowed close inspection of the eye, I have been able to detect epithelial oedema over the whole surface of the cornea, whether or not the patients were

destined subsequently to develop zoster keratitis as ordinarily defined. I suspect that this sign would be constantly found if it were always possible to make a thorough examination. Corneal sensation is always impaired, if not abolished. The intra-ocular tension in an uncomplicated case is said to be reduced, but the swollen state of the eyelids commonly prevents the examining fingers from gaining any reliable information concerning this feature.

The forementioned eye conditions would appear to be essential elements in the clinical picture. The inconstant ocular complications will be considered afterwards. Hutchinson is often said to have believed that these complications never arise unless the eruption appears on the side of the tip of the nose; furthermore, that they can definitely be foretold whenever a spot appears in that situation. But this opinion, expressed in the first paper that he wrote on the subject, was modified by his later experience, which provided him with opportunities to observe exceptions to his rule. Bowman, Jessop, and others have also reported cases where the eye escaped in spite of spots being present on the tip of the nose, and cases in which severe ocular complications were unaccompanied by a nasal rash. Nevertheless, the so-called Hutchinson rule is a useful rough-and-ready guide, most observers being agreed that subsequent eye trouble is rendered more probable by involvement of the oculo-nasal twig. The true explanation may be as follows: Of the three main branches of the ophthalmic nerve, the frontal is the only one to be constantly implicated in herpes zoster of this region. Often it is the only branch to be so affected. Clinical experience tends to show that ocular complications are more to be feared in those cases where the eruption is most extensive, involving other branches in addition to the frontal one.

During the active stage of ophthalmic zoster the general principles of treatment are rest in bed, sedatives to relieve the pain, light diet, and a bland, oily dressing for the rash. Mr. C. B. Goulden's clinical experience has led him to believe that, under conditions of rest and skilled nursing, the patients are less likely to develop serious ocular complications; and that, if complications are not entirely warded-off, their severity will at least be tempered. Strong, irritant preparations applied to the skin can only do harm. A simple, oily dressing will suffice, and will lessen the liability to deep scarring. In some cases, however, the skin is so tender to the slightest pressure that no dressing will be tolerated. Routine measures of treatment for the conjunctivitis are usually contra-indicated by the condition of the eyelids, which are so swollen and tender that one is reluctant to force them apart for the purpose of irrigation. Moreover, the adjacent skin would

be still further damaged by the repeated soaking of its already excoriated surface. For these reasons it is better to neglect any conjunctival inflammation that exists at the height of the rash. The occasional instillation of oil will reduce the tendency of the lid margins to become stuck together by dried secretion.

Ocular Complications.—The ocular complications now to be considered may arise at any moment during the eruptive stage, but sometimes make their first appearance weeks or months after the rash has subsided, when they might be more correctly described as sequelae. Occasionally they precede the eruption. These are the possible complications:—

(1) Keratitis.

(2) Iridocyclitis.

(3) Ocular palsies.

(4) Optic neuritis.

Keratitis affects the substantia propria in any of its layers, but hardly ever produces ulceration. Detailed examination is slightly impeded by the oedematous state of the epithelium mentioned above. A typical case shows irregularly shaped opacities situated at various depths in the substance, together with oedematous striae and generalised haziness. Folding of Descemet's membrane can often be detected in cases where the substantia propria is not sufficiently opaque to conceal the posterior layers of the cornea. Paton considers that this folding of Descemet's membrane is probably due to the hypotonia which has often been observed in ophthalmic zoster. In my opinion the existence of deep keratitis offers a far readier explanation thereof. Keratitis disciformis, interstitial keratitis, and other forms of deep keratitis commonly produce folds in this membrane, as a result of swelling and distortion of the hindmost lamellae of the corneal substance. Now, although the most characteristic residual opacity after zoster keratitis is situated in the anterior lamellae, yet it is not these layers that are solely, or even mainly affected during the active stage. Zoster keratitis is, in fact, a deep keratitis, and is therefore apt to produce folding of Descemet's membrane—a phenomenon whose absence may readily be noted in many soft eyes suffering from, *e.g.*, simple detachment of the retina.

The severity and duration of zoster keratitis varies greatly among different patients. Under appropriate treatment by means of a mydriatic it may settle down within a fortnight, but more often drags on for weeks or months in spite of promptly applied remedies. In severe cases the cornea is not uncommonly invaded

by new vessels. Some opacities are always found after an attack. They may occupy any layer of the substantia propria, and may present no special features, but one type is characteristic—a round gray opacity situated in the anterior layers of the substance, and formed by the coalescence of numerous smaller dots. Several of these round gray areas may be found close together, and overlapping at their margins.

Probably the iris never remains perfectly normal throughout an attack of herpes zoster ophthalmicus. The pupil is usually small and sluggish as compared with that of the fellow eye. Spasm of the sphincter, together with vascular congestion and some infiltration of the iris stroma, may account for this condition of the pupil. Sometimes, on the other hand, the pupil of the affected eye is found to be dilated by reason of a partial third cranial nerve palsy. When keratitis supervenes, iridocyclitis is invariably found to some extent, as indeed it is in all forms of deep keratitis. Dots of keratic precipitates can be seen unless the corneal haze is too pronounced. Iridocyclitis may also arise as a complication or sequel in cases that have escaped keratitis. Often it is accompanied by a profuse plastic exudation in the anterior chamber, so that the pupil is prevented from responding to the action of atropine, and the patient is exposed to the risk of secondary glaucoma, either at the time of active inflammation, or in the future, when the exudate will have given rise to obstructive adhesions. The intraocular tension may, on the contrary, be lowered from atrophy of the ciliary processes. In some cases atrophy is sufficiently advanced to lead to phthisis bulbi. Since herpes zoster ophthalmicus exposes every patient to the risk of losing an eye from severe iridocyclitis, whether accompanied or not by keratitis, it would seem worth while to administer an occasional mydriatic drop for a few weeks after the beginning of an attack, especially when we consider that the pupil's response to the action of atropine is defective, even in cases that have no iridocyclitis. This suggestion does not, however, imply that the worst cases could infallibly be saved by such prophylactic measures.

Ocular palsies not uncommonly occur, involving the third, fourth, or sixth cranial nerves. It is unusual for the whole of the third nerve to be affected at the same time. Often only one branch is involved, *e.g.*, that which supplies the levator palpebrae superioris. During the eruptive stage there is always some ptosis from swelling of the upper lid, so that it is not always possible to diagnose paralysis of the levator with certainty until the rash has begun to decline. The prognosis with regard to these palsies is good, because most of them disappear in less than six weeks, but they do occasionally persist for a much longer time. Browne reports the interesting case of an elderly man who, at the end

of four days' thoracic neuralgia, developed a bilateral herpes zoster rash in the areas supplied by the dorsal nerves III - X. The left upper lid now began to suffer from *anaesthesia dolorosa*. Eight days later there ensued a partial palsy of the left third cranial nerve, resulting in ptosis and mydriasis. This palsy lasted for a little more than a week, and was not accompanied by any eruption in the areas of fifth cranial nerve distribution.

Optic neuritis is a rare complication. Bowman, Paton, and others have seen cases in which marked secondary optic atrophy was visible in the affected eye after an attack of ophthalmic zoster.

Sequelae.—It has been stated above that keratitis, iridocyclitis, etc., may follow at some considerable time after an attack. Residual opacities of the cornea, phthisis bulbi, and secondary glaucoma have also been discussed. Other sequelae to be mentioned are:—

(1) Impaired corneal sensation.

(2) Scleritis.

(3) Patches of atrophy in the iris.

The reason why corneal sensation is recovered in some cases but not in others, is made intelligible by the pathological researches of Head and Campbell, who found that the inflammatory damage sustained by the Gasserian ganglion varied greatly among different patients. In a severe case many of the nerve-cells are completely destroyed from the first, or afterwards become strangled in a mass of organising scar-tissue. A mild attack, however, does not preclude complete recovery of the infected cells. Impaired corneal sensation is in most cases evident for many months after the attack. There are many examples recorded in which sensation had not fully recovered several years later.

Scleritis appears in the form of one or more nodules about two months after the rash has disappeared. Most of the reported instances have occurred in association with iridocyclitis. The nodules are painful and irritable. They usually remain active for several months, and when they fade away their site is marked by a permanent slate-coloured scar.

Patches of atrophy in the iris are an exceedingly characteristic sequel. They are, as we should expect, commoner and more extensive in eyes which have had iridocyclitis, but are often to be found in uncomplicated cases. These patches present the customary atrophic features of thinning and discolouration of the iris stroma.

In addition to these ocular sequelae, an attack of herpes zoster ophthalmicus may be the forerunner of most unpleasant after-pains referred to the skin areas which were attacked by the rash.

These pains may persist for years, and are associated with abolition or impairment of sensibility in the affected skin. Hutchinson believed that older people are particularly subject to this troublesome sequel. One elderly patient of Forget suffered so grievously in this manner that he was incited to suicide.

Association with Chicken-pox.—During the last few years attention has frequently been directed to the close connection which exists between herpes zoster and chicken-pox. In hospitals and other institutions the presence of a case of herpes zoster has often been held responsible for an otherwise inexplicable outbreak of the other disease. This association has been so commonly remarked that it can hardly be attributed to a series of coincidences. Moreover, there have been cases reported in which a typical chicken-pox rash and an attack of herpes zoster have assailed the same patient within a few hours. The prevailing opinion is that both conditions are due to infection by closely-related ultramicroscopic viruses. That the viruses are not identical is shown by the failure of an attack of chicken-pox to confer immunity from herpes zoster. Mayou had two cases in which influenza heralded a herpetic eruption, but, in view of the wide prevalence of influenza in this country, it would be necessary to collate an enormous number of similar instances before any affinity could be proved between the two maladies.

Symptomatic herpes.—Symptomatic herpes zoster ophthalmicus may be the result of cerebral tumour, tabes, or syphilitic basal meningitis. It may also be caused by drugs, among which arsenic is apparently the most noxious to the Gasserian ganglion. Hutchinson reported a case of herpes frontalis in a middle-aged woman who had been using Fowler's solution (liquor arsenicalis) as a remedy for psoriasis. Bruere found some form of neuropathic keratitis in a syphilitic patient who had undergone salvarsan injections. A man under the care of Hegner sustained sloughing of the cornea after two injections of neo-salvarsan for syphilis. Pearce published interesting notes of a child, aged seven, who developed ophthalmic zoster after a course of Fowler's solution employed in the treatment of chorea. The most likely interpretation seemed to be that the child was afflicted with symptomatic herpes zoster due to arsenical poisoning of the Gasserian ganglion. In the same ward, however, another child developed chicken-pox three days later. This second child had remained in the ward for the preceding thirty days, during which time there had been no other visitation of chicken-pox or herpes zoster, apart from that of the above-mentioned first child; who may therefore be regarded as a probable case of epidemic herpes zoster, not imputable to the ingestion of arsenic.

Pathology.—More than seventy years ago von Baerensprung expressed the opinion that herpes zoster should be ascribed to lesions of the nervous system. He found support for this opinion in a post-mortem examination which he was soon afterwards enabled to make on a suitable case. Weidner in 1870 found pathological changes in the cells and connective tissue of the Gasserian ganglion during the autopsy performed on a man who had suffered from herpes zoster ophthalmicus five years previously. In the following year Wyss noted softening and congestion of the ganglion; haemorrhages chiefly affecting the cells governing the first division of the nerve; and histological changes in the nerve branches from the ophthalmic division, as contrasted with offshoots of the second and third divisions investigated as controls. The work of Head and Campbell was still more conclusive, consisting, as it did, of exhaustive observations at all stages in a series of cases. They found ganglionic haemorrhages in recent cases, sclerosis in old cases, and destruction of nerve-cells in proportion to the severity of the infection. On sifting the clinical records of more than four hundred cases they could discover only four examples of a patient being attacked twice.

Illustrative Cases.—The following cases furnish examples of the more important ocular complications:—

Case I, a woman, aged 51 years, was confined to bed for two months at the beginning of 1931 with an attack of left herpes zoster ophthalmicus in which the rash involved the forehead, lower lid, and side of the nose. Severe kerato-irido-cyclitis arose as a complication. Eighteen months later the cornea displayed numerous large, superficial new vessels, and a great deal of dense opacity affecting all the layers. The pupil was completely immobile as a result of extensive posterior synechiae. Tension was raised, and the eye was quite blind. One interesting feature in this case was the existence of several slate-coloured scleral scars, two of which had occasioned so much thinning of the sclera as to produce localised staphylomata, resembling small, dark-blue berries.

Case II, a woman, aged 47 years, who came up to hospital complaining of pain in the right eye for the last two days. Her attack of herpes zoster had begun nearly a fortnight previously, so that the rash, which had alighted on the forehead and side of the nose, was in process of settling down. On examination the epithelium of the right cornea was uniformly bedewed; there was faint, generalised haze of the substantia propria; and numerous keratic precipitates were seen on the posterior surface. The pupil was small and inactive. The iris showed loss of pattern, lack of lustre, and vascular engorgement. Several coagulated flakes were adhering to the anterior lens capsule. The pupil responded well

to the repeated instillation of atropine, there being only one unresolved posterior synechia at the end of two hours. When she attended again a week later, having in the meantime used atropine drops thrice daily, that last synechia had broken free, and the iridocyclitis was progressing favourably. Since her previous visit she had developed a right sixth cranial nerve palsy; but, the right eye having been covered, no diplopia had been appreciated. This palsy cleared away in rather less than a month. The outcome of the iridocyclitis was also favourable, corrected vision of 6/9 being recovered by the right eye at the end of the attack.

Case III, a man, aged 63 years, came to the hospital suffering from left herpes zoster ophthalmicus. For the past eight days he had felt sharp neuralgic pains, and the characteristic rash appeared three days ago. Herpetic sores, associated with redness and swelling of the skin, occupied the forehead and part of the lower lid margin. Sensation to light touch was lacking on the eyelids. The corneal epithelium was oedematous, as expressed by the presence of many minute vesicles of inconstant size. A few cracks and striae were noticed in the deeper layers of the substantia propria. Visible particles were circulating in the anterior chamber. The patient was put to bed. During the next few days the rash developed further, spots appearing at the margin of the upper lid, and down the left side of the nose; but he escaped serious eye trouble. The keratitis was mild, so that when he was seen a few weeks after his discharge from hospital, there were merely a few small, irregular opacities situated in various layers of the substantia propria.

Case IV was one of symptomatic zoster. A girl, aged 17 years, undergoing treatment in hospital for juvenile tabes, developed the typical rash over the inner half of her right upper orbital margin, accompanied by acute muco-purulent conjunctivitis. At this stage the cornea was perfectly clear. On the following day three small, distinct blebs, visible to the naked eye, and resembling those that appear in cases of herpes febrilis, were found on the cornea. The ulcers resulting from the rupture of these vesicles healed quickly. During the next three days the characteristic picture of zoster keratitis was produced; all layers of the corneal substance showing general haziness interspersed with zones of denser opacity, and vision being reduced to finger-counting. After a weeks treatment with atropine the cornea cleared enough to allow keratic precipitates to be seen on its posterior surface. Corrected vision improved to 6/18 within a month of the onset. The only residual signs in the cornea were a few scattered, irregular areas of opacity, affecting chiefly the middle layers of the substantia propria; also some shrunken precipitates. There was no vascularisation of the cornea.

The chief point of interest in this case, as it seems to me in retrospect, was the appearance of blebs on the surface of the cornea before typical zoster keratitis arose. It has been already mentioned that epithelial bedewing is a common, and possibly a constant feature in the cornea of patients suffering from epidemic herpes zoster ophthalmicus, quite apart from the consideration whether or not keratitis is going to complicate the picture; but I have never seen actual blebs visible to the naked eye in an epidemic case. I do not know whether blebs are a common finding in symptomatic cases, like that of the girl described above, but their occurrence may perhaps be regarded as forming a stage in the transition between herpes zoster and herpes febrilis, between which diseases border-line cases sometimes occur, not conforming to the usual classification.

I wish to express my gratitude to the Moorfields surgeons for allowing me access to their clinical material. Especially I wish to thank my teachers, Sir John Parsons, and Mr. C. B. Goulden, for their instruction and guidance.

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A CASE OF ANGIO-GLIOMATOSIS RETINAE WITH PATHOLOGICAL REPORT

BY

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WE report the clinical and pathological findings of this case because we believe this condition is relatively rare and presents certain features of unusual interest.

Clinical Notes.—C. M. was born on December 14, 1918, and the medical history of the early part of his life was uneventful till July 21, 1931, when he discovered that the left vision was blurred. Examination of the left eye revealed numerous fine vitreous opacities and a circular white woolly-looking mass situated in the retina and encroaching on the upper temporal quadrant of the optic disc. The diameter of this mass was approximately 3 mm. and the upper temporal branches of the central retinal vessels crossed its anterior surface. The neoplasm obscured the optic disc at the point where the upper temporal branches of the central retinal vessels left the parent trunk. The left vision was 6/36 and the pupil reactions and intra-ocular pressure were normal. There was no clinical evidence of disease in the right eye; the Wassermann reaction was negative; tuberculous disease was searched for both clinically and by X-rays, but this proved negative; the urine was normal and the blood pressure 105/60.

In February, 1932, the left vision was reduced to counting fingers at 3 metres, the white mass had increased in size and was more raised (4 - 5 dioptres). Fine opacities were noted in the lens and some of the vitreous opacities were larger. General examination and a blood count proved negative. The mass was thought to be inflammatory in nature.

In January, 1933, the mass was much larger and completely obscured the optic disc. The centre of the mass was raised about 7 dioptres and the margins were blurred and ill-defined. On the nasal side there were two small areas of haemorrhage and crossing its anterior surface were small arteries and veins on their way to and from the temporal part of the fundus. These vessels were partly obscured by the neoplasm at certain points in their course.

This mass was now believed to be a neoplasm and in consultation with Mr. C. H Banford excision was advised and performed on February 15, 1933.

The eye was fixed in Zenker's fluid and divided horizontally.

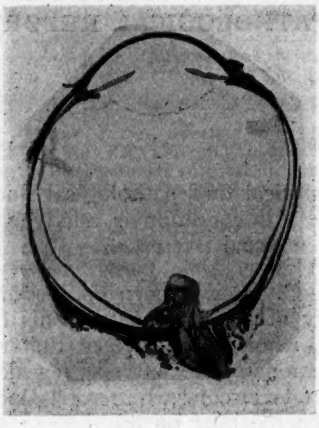

FIG. 1.

Microphotograph to show the neoplasm arising from the retina on the temporal side of the optic disc and overlapping the papilla.

FIG. 2.

Microphotograph showing cystic spaces in the neoplasm near its summit.

Pathological Report.—There is a neoplasm arising from the retina to the temporal side of the optic disc and invading the papilla. It is shaped like a collar-stud and the basal diameter is 2·5 mm. and the antero-posterior depth 4·5 mm. It is composed mainly of endothelial cells, arranged in irregular clumps, and of glial tissue. Near the summit of the neoplasm there are several

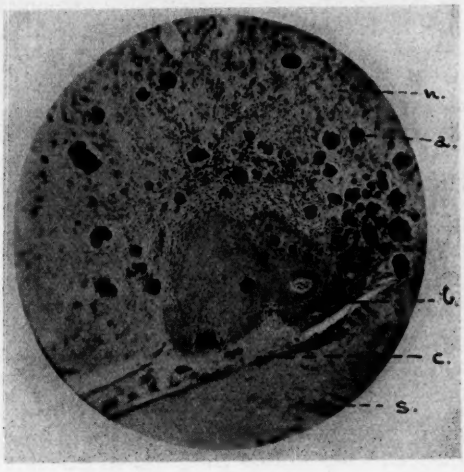

FIG. 3.

Microphotograph to show bone formation and corpora amylacea in the base of the neoplasm and the choroid to the temporal side of the optic disc.

n. Neoplasm.
c. Choroid.
s. Sclera.
b. Bone formation.
a. Amyloid bodies.

cystic spaces filled with granular débris, fibrin, lymphocytes and large mononuclear leucocytes. The walls of these spaces are formed by endothelial cells and glial tissue. Several small capillaries can be seen passing into these areas of cystic degeneration. At the base of the neoplasm there are many amyloid bodies scattered irregularly, and at the temporal edge of the optic disc there is a mass of bone arising from the choroid and passing forwards into the base of the neoplasm.

The neighbouring retina is rucked up and there is a small collection of sub-retinal fluid producing a shallow localized detachment.

Some punctate deposits of leucocytes are present on the back of the cornea, and the anterior surface of the iris and ligamentum

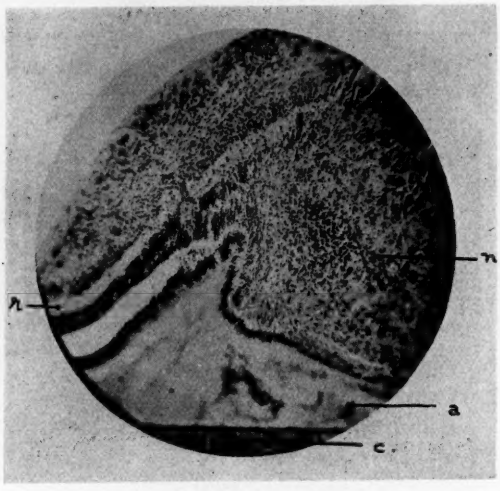

FIG. 4.

This microphotograph shows the temporal edge of the neoplasm infiltrating the retina.

n. Neoplasm.
r. Retina, rucked up and detached.
c. Choroid.
a. Sub-retinal fluid.

pectinatum show a plasma cell and lymphocytic infiltration. The remainder of the eye is normal.

There is no evidence of extra-ocular extension of the neoplasm and we believe it is relatively benign.

The diagnosis of angio-gliomatosis with degenerative changes has been made. The points of interest are that no other lesion was found elsewhere in the body on clinical examination, that the neoplasm grew slowly and the histological picture suggested that it possessed a relatively benign character and was even retrogressive in those parts where cystic degeneration, and formation of bone and amyloid bodies had taken place.

MICROSCOPIC APPEARANCES OF CORNEAL GRAFTS

BY

J. W. TUDOR THOMAS

CARDIFF

IN previous Papers (*Trans. Ophthal. Soc. U.K.*, 1930; *Proc. Roy. Soc. Med. Ophthal. Sect.*, June, 1930; *Lancet* (Hunterian Lecture), February 14, 1931, p. 335), a series of experiments on corneal grafting in rabbits was described and the results of various types of operation were given. Some of these grafts became infected, others became detached, others united. Some of those that united were opaque, some were nebulous, others, clear. In the papers referred to, the grafts were divided into six main groups according to the type of operation performed, as follows:—

1. Transplantation of the whole of the cornea with some conjunctiva.
2. Central or para-central grafts with stitches.
3. Central grafts without stitches.
4. Marginal grafts with stitches
5. Central grafts with parallel stitches passing over them.
6. Central grafts with "cross stitches."

Group 6 was divided into four sub-groups (*a*), (*b*), (*c*) and (*d*), according to the size of the graft and of the bed prepared for it. In the description that follows, the grafts will be referred to as belonging to one or other of the above groups.

All the grafts were of the whole thickness of the cornea. The changes in some of the infected grafts will first be described, and then the detached, and finally the united grafts. For convenience in reference, the number of the animal used in the experiment will be given thus, R.60=Rabbit No. 60. Throughout the description the term "graft" will be used to indicate the transplanted corneal tissue, and the word "cornea" will indicate the rabbit's original corneal tissue as distinguished from the grafted tissue.

The microscopic appearances of transparent corneal grafts will be described separately in another paper.

Infected Grafts

Group 2. R.60. Killed seventh day. There is an invasion of the cornea by free leucocytes and epithelioid cells as well as an infiltration from an adherent iris. The graft itself, with the exception of a small portion in the centre, is infiltrated with leucocytes,

small round cells, and epithelioid cells. These cells have entered from the anterior surface and from the cut ends, and tend to pass along the lines of the corneal fibres, pushing the lamellae apart.

Group 2. R.45. Killed eighth day. The graft is infiltrated with leucocytes, which have entered through the anterior surface and the cut ends, unaccompanied by blood-vessels.

Group 4. R.48. (See Fig. 1). This graft was nearly completely detached when the animal was killed at the seventh day. The

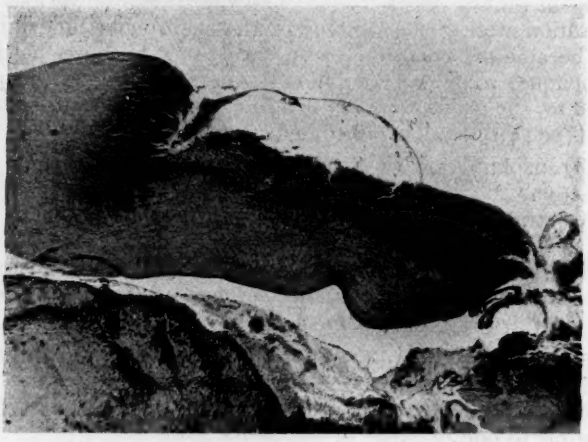

FIG. 1.

R. 48. Showing invasion of graft by cells from without. Magnification ×32.

section shows that the graft has lost some superficial tissue and epithelium near the central margin, and that it has here been invaded by cells entering its anterior surface and at the cut margin. Thus the deep half of the graft is free from these cells, while the superficial half and the cut end have masses of ingrowing cells. These cells consist of leucocytes, or pus cells, and other irregular blue, round or oval cells, partly broken down, which suggests an epithelial origin. These cells have come from the surface and from without. These epithelioid cells are disintegrating and are soon almost unrecognisable.

Descemet's membrane is seen to be a definite barrier to the entry of these cells, so that the deeper layers of the graft are free from them.

Remarks on Infected Grafts

The three infected grafts described show that the graft is apt to become infiltrated with cells from without. Some of these cells are of the nature of leucocytes or pus cells, which in all probability come from the iris or ciliary body and from the conjunctival sac; they penetrate the graft from the cut margins, and also from the anterior surface, while they are unable to penetrate through unbroken Descemet's membrane. They may be found in the graft in large numbers at the end of one week, and are not accompanied by blood-vessels.

Other cells, of an epithelial nature, also penetrate the surface and cut ends of the graft. These may be corneal epithelial cells, or other epithelial cells from the conjunctival sac. The cut ends of the cornea are liable also to be invaded by cells in a similar way, and if the iris is adherent to the cut corneal surface, leucocytes and young capillaries from the iris penetrate the corneal tissue as well.

Detached or Partially Detached Grafts

Eleven partly detached grafts were taken at various intervals ranging from four days up to one month after operation. One of these (R.46) was a marginal graft. All the others were more or less central in position. Three of these are illustrated and a short description of each follows.

Group 4. R.46. (See Figs. 2, 3 and 4). This graft was partly detached when the animal was killed on the thirteenth day after the

FIG. 2.

R. 46. Showing adherent iris, swollen graft, and invasion by blood vessels and leucocytes; new tissue deep to Descemet's membrane. Magnification ×13.

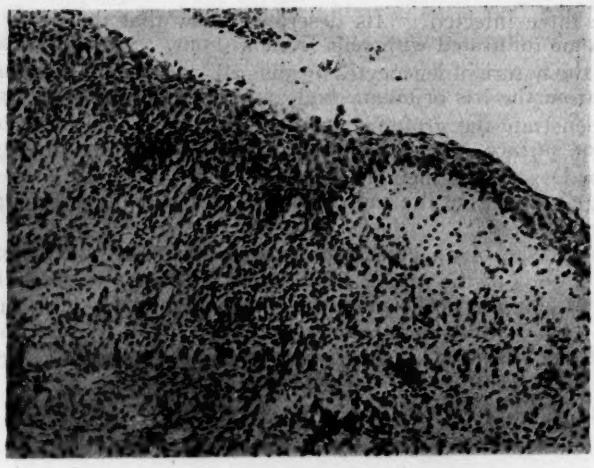

FIG. 3.

R. 46. Showing epithelium dipping into the graft. Magnification X120.

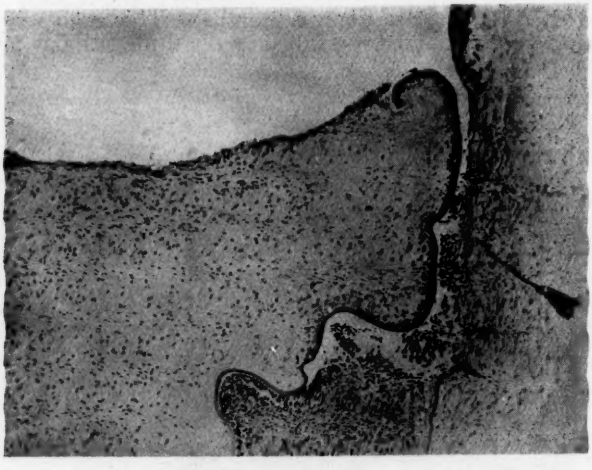

FIG. 4.

R 46. Showing how Descemet's membrane forms a barrier to the progress of cells; leucocytes creeping in front of Descemet's membrane, and corneal epithelium growing down behind it. Magnification X65.

operation. The iris is adherent to one end of the graft, and there is proliferation of the ciliary epithelium, which extends on to the adherent portion of iris. The other end of the graft lies anterior to the cut surface of the cornea, no union having taken place in this portion.

The graft itself is swollen, and three zones can be differentiated. The first zone is at the side to which the iris is adherent: this zone is densely nucleated and vascularised. Some of the cells have round, oval or spindle-shaped basophile nuclei, and these are more numerous than the leucocytes which are present. There are many newly formed capillaries, and the basophile cells appear to be derived from the walls of these capillaries. There is an intermediate zone which is much less densely nucleated; the nuclei are small and round, and the cells are mostly leucocytes.

The third zone is at the anterior surface of the graft, remote from the attached end. This zone is more densely nucleated than the intermediate zone, but much less than the first zone. Its nuclei are to a large extent broken up and consist of leucocytes, many of which exhibit eosinophilic characters, together with small round basophilic cells.

It appears that the superficial zone has become invaded by cells penetrating the anterior surface of the graft, while the deep zone is supplied with cells as a result of vascularization from the adherent iris.

The graft's Descemet's membrane is seen to act as a barrier to the passage of the mass of cells posterior to it, which are derived from the iris. A few leucocytes have found their way from without along the anterior surface of Descemet's membrane for a short distance. The graft epithelium is present over about half its surface, that is the portion adjacent to the attached margin, covering the first and the intermediate zones. It is absent over the superficial zone which has been described. The epithelium has grown over the cut end of the graft on to a small portion of the attached iris.

In places, the epithelial cells can be seen to pass into the substance of the graft in the form of plugs along the line of the corneal fibres. These cells seem to penetrate deeper into the graft in certain parts, and their large blue nuclei can be seen deep to the new and irregularly limited epithelium. The effect of this invasion by epithelial cells is that when viewed under a low power, the graft in this region is much more blue in colour than any other part of the graft or of the cornea. These cells appear to mingle with other cells derived from capillary walls in the substance of the graft.

Group 5. R.74. (See Fig. 5). This graft was partly vascularized but detached at one margin when the animal was killed one month

after the operation. The graft is swollen and densely nucleated and its Descemet's membrane is thrown into folds. Newly formed blood-vessels are present in the superficial layers of the cornea, extending to the cut corneal surface; associated with these blood-vessels are numerous cells, which are round or oval, in the immediate vicinity of the blood-vessels, and more spindle-shaped in the less densely nucleated adjoining areas. Many of these cells appear to be derived from the capillary walls.

The iris is extensively adherent to the graft and has formed a considerable amount of new tissue behind the graft's Descemet's

FIG. 5.

R 74. Showing protruding graft with its various zones; adherent iris; new tissue deep to Descemet's membrane; folds in Descemet's membrane. Magnification ×16.

membrane. One end of the graft is separated from the cornea by a mass of leucocytes and some lighter stained oval cells; this mass has an epithelial covering extending from the cornea to the graft for a short distance. The remainder of the graft has lost its epithelium for the most part.

The protruding superficial part of the graft is more or less amorphous and devoid of cells. The deeper tissues of the graft exhibit the following characteristics, described from without inwards and towards the attached end of the graft:—

(*a*) A zone containing broken-down leucocytes and nuclear débris.

(*b*) A densely nucleated zone containing leucocytes without blood-vessels.

(*c*) A zone containing leucocytes, capillaries, and cells with large spindle-shaped nuclei.

It therefore appears that in this case there was little or no invasion of the graft by cells from without, and that there is a distinct difference in the character of the cells in various zones.

R.84. (See Fig. 6). This graft was slightly detached at one margin when the animal was killed on the sixth day after operation. At one end of the graft there are a few elongated endothelial cells between its Descemet's membrane and that of the cornea; the stroma of the superficial half of the graft is united to that of the cornea by exudate, which contains a few leucocytes. The other end of the graft is joined to the cornea by a larger mass of exudate containing endothelial cells, a few leucocytes, and other cells, possibly derived from the corneal fibre cells. This cellular invasion has extended into the graft for a short distance, and also into the cut surface of the cornea. The cut ends of the cornea, and the graft itself, are swollen. Leucocytes are present between the graft's posterior endothelium and Descemet's membrane.

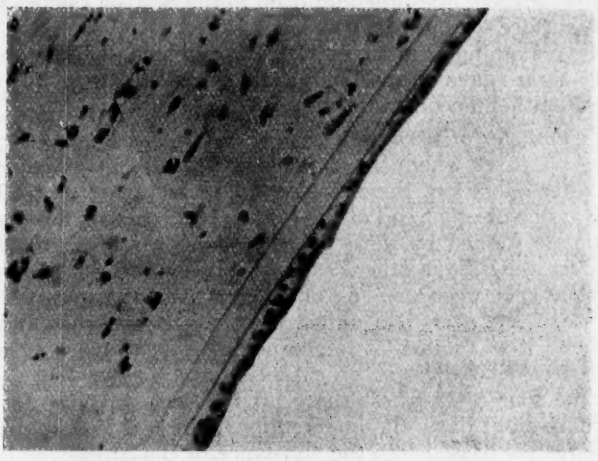

FIG. 6.

R. 84. Showing leucocytes between the endothelium of the graft and Descemet's membrane. Magnification ×530.

Remarks on partly Detached Grafts

(1) THE TEN CENTRAL GRAFTS WILL FIRST BE CONSIDERED :—

(*a*) *Changes in the adjoining cornea.*—Blood-vessels had extended from the periphery to the cut surface in four cases, the earliest being at eight days. Swelling and increase in thickness of the cut margins of the cornea were noticed in eight cases. In two of the early cases (four days and five days respectively), spindle-shaped cells were found to have entered the cut ends of the cornea from masses of exudate adjoining them; this exudate had been formed mostly by the iris.

In two other cases (eighteen and twenty-one days respectively), blood-vessels from the adherent iris had found their way into the substance of the cornea through its cut margins. The corneal epithelium in all cases showed signs of proliferative activity.

In two cases (four days and five days respectively), the corneal epithelium had grown half-way down the cut margin of the cornea, and then on the surface of a mass of exudate intervening between the cornea and the graft.

In two other cases (six days and eight days respectively), the epithelium extended over the surface of a mass of exudate on to a portion of the surface of the graft.

In two other cases (nine days), the epithelium had grown half way down the cut corneal surface, and in one of these cases the epithelium passed on to a portion of the graft; one of these also exhibited growth of epithelium deep to the graft at one end, lying on the surface of some exudate.

The remaining four cases (fifteen, eighteen, twenty-one and twenty-eight days respectively), all exhibited a growth of the corneal epithelium on to the surface of the graft.

(*b*) *Character of tissue intervening between graft and cornea.*—In the six cases where the animals were killed at or before nine days after operation, there was found in each case newly formed tissue at one or other end of the graft. In four cases this consisted of exudate formed by the iris and not yet vascularized. One of these, as well as one other case, exhibited vascularized iris tissue intervening between one end of the graft and the cornea. In one other case, the graft had united primarily at one end, and at the other end it was joined to the cornea by a small mass of exudate, apparently derived from corneal tissue.

In the four cases where the graft had been in place for fifteen to twenty-eight days, the intervening tissue was vascularized, and blood-vessels passed into the substance of the grafts.

(*c*) *New tissue deep to the graft's Descemet's membrane.*—In one case (four days) a film of exudate formed by the iris extended behind the graft. Four others (nine to twenty-eight days) exhibited

new formation of vascular tissue behind Descemet's membrane, in the formation of which the iris had taken a large part.

(*d*) *The graft's Descemet's membrane.*—This membrane was found to act as a barrier through which stray cells in the anterior chamber could not pass. This was noticed particularly in the graft taken at eighteen days after operation.

Four grafts showed considerable wrinkling and folding of Descemet's membrane, and in one of these the membrane occupied a position folded over one end of the graft. In some cases, one end of the membrane occupied a position in front of the cut surface of the adjoining cornea.

(*e*) *Changes in the epithelium of the graft.*—A complete loss of epithelium over a considerable portion of the surface of the graft was noted in the first six cases (from four to nine days), and in two other cases (twenty-one and twenty-eight days), the epithelium was partly lost. Two of the grafts had epithelial coverings (fifteen and eighteen days). In one case (twenty-one days), the epithelial cells were found to have extended into the substance of the graft in certain parts. In two cases, the epithelium had grown so as to cover part of the cut end of the graft.

(*f*) *The posterior endothelium of the graft.*—In four cases, the endothelium was missing, one of these being the graft taken four days after operation.

(*g*) *Swelling of the graft.*—In eight out of the ten grafts now being described, there was considerable swelling of the graft, with marked increase in thickness.

(*h*) *Changes in the stroma of the graft.*—The nuclei in the graft were in a state of fragmentation in six grafts (four, five, six, eight, nine and twenty-eight days respectively). The graft was fairly free from cellular invasion in three cases (four, nine and nine days respectively). In two cases (eight and eighteen days respectively), there was an invasion of the graft by leucocytes and other cells, which had entered through the free end of the graft from outside. In four cases there was an invasion of the graft from the anterior surface by leucocytes and what appeared to be epithelial cells; this was noted as early as five days and as late as twenty-one days.

Six of the ten grafts showed invasion of the stroma by blood-vessels. The earliest was in the five-day graft, where a few capillaries, together with some spindle-shaped cells, had proceeded from the iris into a small portion of the attached end of the graft. The four grafts taken at four, six, nine, and nine days respectively, showed no such invasion by blood-vessels.

The eight-day graft was vascularized near its margin by blood-vessels supplied from the adherent iris, and by others which had

grown in from the margins of the cornea. Of the remaining four grafts (fifteen and twenty-eight days), three were vascularized incompletely by vessels coming from the iris and from the margin of the cornea, and one was completely vascularized.

The appearance of the twenty-eight day graft has already been described, indicating the transitional characteristics in various zones extending from the deep vascularized portion to the superficial and much less cellular part.

(2) THE MARGINAL GRAFT (thirteen days).

There was proliferation of the ciliary epithelium and invasion of the graft by blood-vessels. The corneal epithelium had grown on to some exudate, posterior to the graft. The cut ends of the cornea were swollen. Between the graft and the cornea there was vascularized tissue derived from the iris; this tissue also extended behind the graft's Descemet's membrane. Descemet's membrane was tortuous in outline and formed a barrier through which cells could not pass.

The graft's epithelium was partly lost; in places the epithelial cells passed into the substance of the graft. Some regeneration of epithelium was evident where it had covered a cut margin of the graft and passed on to the surface of iris tissue. The graft's endothelium was mostly lost, and the graft itself was swollen. The stroma of the graft showed fragmentation of its nuclei, and vascularization at the attached end.

United Grafts

Group 1. (Graft consisting of the whole of the cornea). R.3. This animal was killed nineteen months after the operation. At that time the centre of the cornea was roughened and opaque, while there was a partially clear narrow zone at the margin of the cornea. The anterior chamber was present.

The section shows thickening of the corneal epithelium, especially near the centre. The stroma contains blood-vessels and many nuclei, especially in the superficial half. At the partly clear marginal zone the corneal fibres are more regularly arranged, and the nuclei are thinner than in the opaque central portion; the epithelium also is less thick and more regular. Descemet's membrane is present and is rather thick (0.022 mm.). It possesses a single endothelial layer.

At the end of the graft's Descemet's membrane there is an adhesion of the iris to the graft. This adhesion is near the root of the iris, and from this point centrally the iris is free. Peripheral to the adhesion of the iris, there is a portion of the original Descemet's membrane extending to the angle of the anterior

chamber. This piece of Descemet's membrane is quite as thick as the graft's Descemet's membrane and is 0·9 mm. in length. It possesses an endothelial layer, and the iris is not adherent to its posterior surface. Probably this fact accounts for the absence of glaucoma in this eye, the aqueous could find its way past the peripheral anterior synechiae to the original angle of the anterior chamber to pass into the blood stream.

Group 2 R.16. This graft was opaque when the animal was killed three months after the operation.

The section shows the iris to be adherent to the graft at each end, and irregular fibres to have grown across deep to the graft. The graft's Descemet's membrane has been thrown into folds. The superficial fibres of the graft lie close together, but in the rest of the stroma there are irregular spaces between the fibres. The corneal fibre nuclei are present and stain well, but there are fewer nuclei in the centre of the graft than in the peripheral portion.

R.58. (See Fig. 7). This graft was opaque when the animal was killed eighteen months after the operation. The opacity was noted as being mostly in the deep portion of the graft.

The section shows the graft's Descemet's membrane wrinkled and in folds, while deep to it is a layer of vascularized tissue continuous with the iris tissue. The graft itself contains a few blood-vessels, some of which have come through the cornea and some

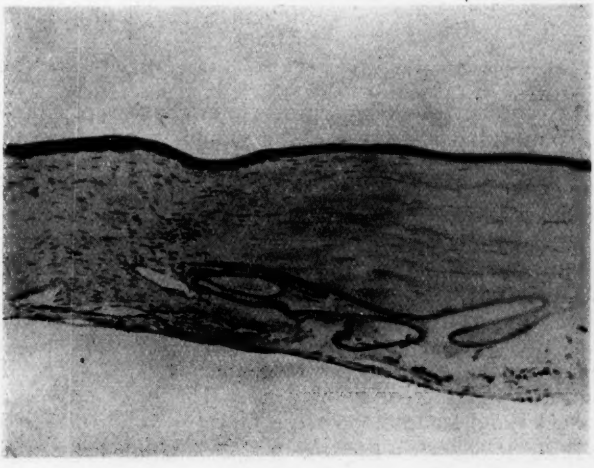

FIG. 7.

R.58. Showing vascular nature of new tissue deep to Descemet's membrane. Magnification ×117.

from the iris. The graft fibres are not separated by irregular spaces to any appreciable extent, and the nuclear content is not very high. The graft is covered with a layer of epithelium. The folds in Descemet's membrane, and the presence of vascular tissue on its posterior surface, account for the clinical fact that the opacity of the graft was mostly in its deep part.

Group 4. R.50. This animal was killed at the fifteenth day. The section shows considerable loss of the graft's epithelium, while the corneal epithelium has grown on to the surface of the graft near one margin. A few leucocytes have penetrated the surface and each end of the graft. There is a mass of tissue extending behind the graft's Descemet's membrane from the cut corneal

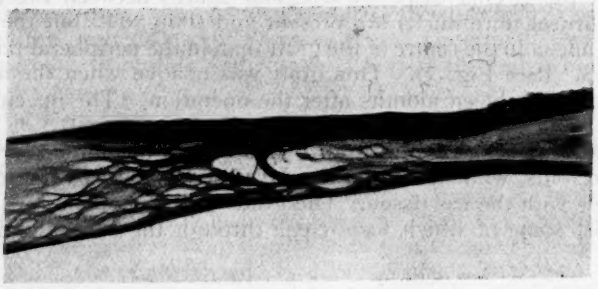

FIG. 8.

R. 55. Showing a new Descemet's membrane. Magnification ×55.

margin to the cut scleral margin. This consists of fibro-blastic tissue, coming partly from the sclera, and largely from the iris; it contains a fair amount of iris pigment, and is vascularized to some extent. This tissue extends forwards through a break in the middle of the graft's Descemet's membrane, and in this region a few leucocytes can be seen in the graft's stroma. The graft is thickened, and its anterior surface is raised above the general corneal surface.

R.62. This graft was opaque when the animal was killed ten months after the operation. The section shows the graft's Descemet's membrane much folded and wrinkled. The iris and lens capsule are adherent to the graft. The graft stroma contains many nuclei and some blood-vessels.

Group 5. R.55. (See Fig. 8). This animal died sixteen months after the operation, the graft at that time being only slightly opaque and only slightly nebulous at the centre. The section shows an extensive new formation of Descemet's membrane

joining the cut end of the corneal Descemet's membrane on one side to the posterior surface of the cut end of the corneal Descemet's membrane on the other side. The new membrane runs close to the posterior surface of the graft's Descemet's membrane, and in the central area the two membranes fuse together. No definite blood-vessels can be seen in the graft, and the iris is free.

Spindle-shaped spaces are present around the graft and also, to a lesser extent, in the superficial layers of the graft's stroma; the middle and deep thirds of the centre of the graft, however, exhibit a regular arrangement of the fibres and practically no spindle-shaped spaces.

The central area of the graft during life showed very little opacity, and the section shows this portion to have a regular Descemet's membrane without folds and closely adherent to the new membrane; the stroma shows only a comparatively small number of spindle-shaped spaces, and such as are present are found only in the superficial layers. Furthermore, it is to be noted that there is no new tissue formation behind the central portion of the graft's Descemet's membrane, apart from the new membrane which in this situation has fused with it.

Group 6 (*a*). R.80. (See Fig. 9). This graft had a large area which was nearly clear when the animal died of old age ten months after the operation.

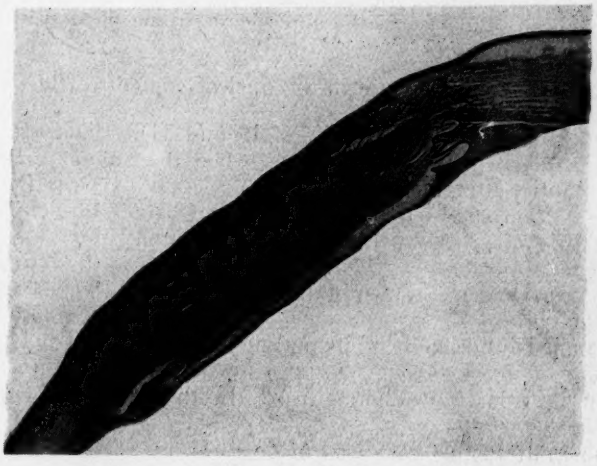

FIG. 9.

R. 80. A portion of the graft, showing a fold in the middle of its Descemet's membrane. *Magnification X34.*

The section shows some folding of the graft's Descemet's membrane near the margins, and in this situation there is some new tissue deep to the membrane consisting of cells with long, pointed, straight nuclei, running more or less parallel to each other, behind which there is an endothelial lining. At the middle of the graft there is a fold in Descemet's membrane with a localized formation of new tissue similar to that described at the margins. Between this central fold and the margins, the graft's Descemet's membrane is regular and free from folds, and lined posteriorly by endothelium.

The graft stroma exhibits regular arrangement of its fibres for the most part, but in the superficial layers there are some spindle-shaped spaces, and just deep to these the fibres are not clearly differentiated but tend to form an amorphous mass. The graft possesses an epithelial covering, the thickness of which varies in different parts, from one to seven cells thick. The iris is not adherent to the graft, although some pigment on the posterior surface of the corneal Descemet's membrane near the cut margin on one side indicates that there was an adhesion of the iris at this situation for a short time.

No blood-vessels can be seen in the graft. The area of graft which was nearly clear, shows the following microscopic appearances to account for the presence of slight opacity:—

(*a*) A fold in the middle of its Descemet's membrane with a localized new tissue formation behind it.

(*b*) Some irregularity of the superficial stroma fibres with some spindle-shaped spaces.

(*c*) A very slight increase in the nuclear content of the graft.

Group 6 (*b*) R.90. (See Figs. 10 and 11). This graft was quite opaque with an adherent iris when the animal was killed three months after the operation.

The section shows that there is an extensive adhesion of the iris to the graft, with much new tissue formation behind the graft's Descemet's membrane. This tissue is vascularized from the iris and a new Descemet's membrane has formed behind the tissue to join the corneal Descemet's membrane. The graft's Descemet's membrane is unbroken and its outline is slightly wavy. The graft stroma contains many nuclei and a few blood-vessels which have grown in from the adherent iris. In the graft are numerous spindle-shaped spaces.

The graft in this case was made the same size as the bed in the cornea prepared for its reception. The section, however, shows that the ends of the graft's Descemet's membrane are separated by a considerable interval from the cut ends of the corneal

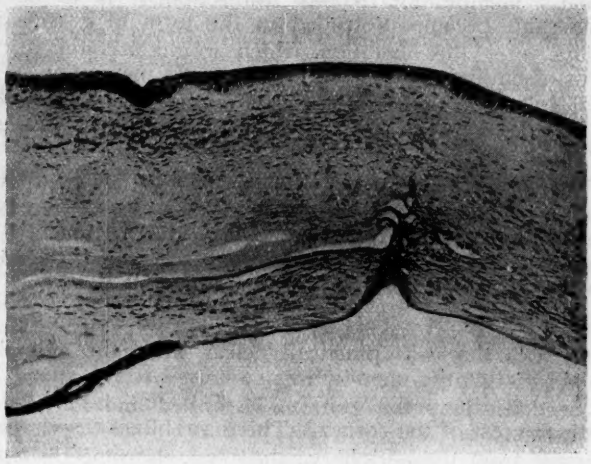

FIG. 10.

R. 90 Showing vascular nature of new tissue deep to Descemet's membrane; spindle-shaped spaces in graft, especially in the superficial half, which also shows an increase in the number of nuclei. Magnification ×83.

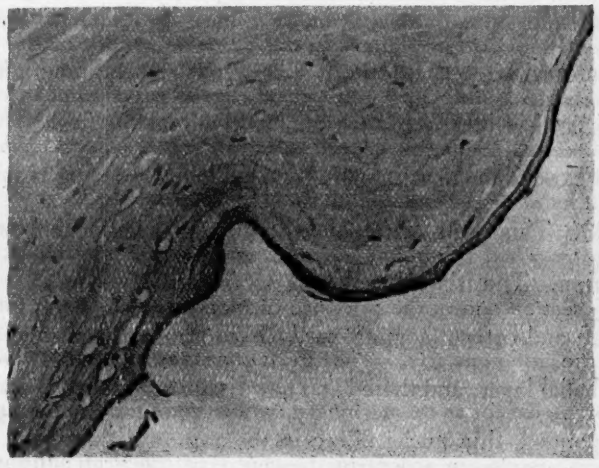

FIG. 11.

R. 90. Showing new Descemet's membrane where it is attached to the original corneal Descemet's membrane. Magnification ×201.

Descemet's membrane. In this connection, it is to be noted that the graft became protruded in the form of a cone about nine days after the operation, which would account for some waviness of outline of the graft's Descemet's membrane.

This waviness of outline necessarily implies a shortening of the linear distance between the two ends of the graft's Descemet's membrane.

This, coupled with the fact that the cut ends of the corneal Descemet's membrane were slightly curled up, accounts for the wide separation referred to between the graft's Descemet's membrane and that of the cornea. In the gap so formed, the iris was able to secure a good hold and became adherent.

Group 6 (*c*). R.94. This graft was flat and well united, with a central area that was practically clear when the animal died twenty days after the operation.

The section shows the graft to be united and fairly well in line with the rest of the cornea. There are blood-vessels passing to the graft from the periphery; these vessels come through the cornea, and many capillaries are present at the junction of the graft and cornea. The centre of the graft has only a few small blood-vessels, and for the most part its fibres are regularly arranged without spindle-shaped spaces.

The nuclei in the graft are more numerous than normal, but the nucleation is much more marked at the periphery. The graft has a small adhesion of the iris at each margin. The iris has not apparently contributed much to the vascular supply of the graft. The interval between the graft's Descemet's membrane and that of the cornea is filled up by fibroblastic cells, which appear to have arisen partly from the cornea and partly from the iris. There is no new tissue formation behind the graft's Descemet's membrane except close to the margins. A good epithelial covering is present, as well as a single endothelial layer posteriorly.

R.93. This graft was opaque at the margins and nebulous at the centre when the animal died two-and-a-half months after the operation. The iris was adherent to the graft.

The section shows the presence of blood-vessels at the junction of graft and cornea, coming partly from the periphery and partly from the adherent iris. The graft has an epithelial and an endothelial layer, and there is no new tissue deep to its Descemet's membrane except at the periphery, where there are some long cells with pointed, thin nuclei filling in the gap.

Blood-vessels are absent in the centre of the graft; the stroma in this region has many more nuclei in the superficial layers than in the deeper layers. The fibres in the deep half of the graft are fairly regularly arranged.

Remarks on United Grafts

The ten united grafts which have been described were taken at various intervals, ranging from fifteen days to nineteen months after operation. One of these was a graft consisting of the whole of the cornea together with some conjunctiva; two were marginal grafts; the remaining seven were more or less central in position.

(1) THE SEVEN CENTRAL GRAFTS WILL BE CONSIDERED FIRST:—

These may be divided into three groups, according to the degree of opacity present:—

(*a*) Opaque grafts.

(*b*) Grafts with a nebulous central area.

(*c*) Grafts with a central area nearly clear.

(*a*) *Opaque grafts.*— Three grafts were opaque (R.16, R.58, and R.90). Two of these (R.16 and R.90) were taken three months after the operation. In each case the iris was adherent and Descemet's membrane was thrown into folds. New tissue was present behind Descemet's membrane in each case, and in two of them this tissue was vascularized by the iris. In one case, there was a new Descemet's membrane, which was separated from the old membrane by some new tissue. Each of the grafts had blood-vessels passing to it from the cornea, supplemented in two cases by vessels from the adherent iris.

In two of the grafts there were irregular spaces between the fibres of the stroma. One of the grafts showed a close packing together of its superficial fibres. The nuclear content of each graft was increased, markedly so in two cases; the graft in which the nuclear content was not much increased had very few irregular spaces between its fibres, and the opacity in this case had been noted as being in the deep part of the graft. Epithelium was present in each of the three grafts.

(*b*)*Grafts with a Nebulous Central Area.*—There were two such grafts (R.55 and R.93), taken at sixteen months and two and a half months respectively after operation. The iris was adherent in one case. Descemet's membrane in each case was not in folds. New tissue formation deep to Descemet's membrane in each case was confined to the marginal part of the graft and was not present behind the central area.

One of the grafts appeared to be devoid of blood-vessels, and in the other graft they were only appreciable near the margins. The deep half of each graft showed a regular arrangement of its fibres, while the superficial third or so showed increase of nuclei with closely packed fibres in one case, and spindle-shaped spaces between the fibres in the other case. Each graft had an epithelial covering.

(*c*) *Grafts with a Central Area nearly clear.*—There were two such graft's (R.80 and R.94) taken at ten months and twenty days respectively after operation. One of these had an adherent iris (R.94) and no folds in Descemet's membrane nor new tissue deep to Descemet's membrane, except at the margins. The other graft had one fold in the middle of its Descemet's membrane, and there was no new tissue formation behind this membrane except at the periphery.

The twenty-day graft was slightly vascularized at the margins, and in the other graft the blood-vessels which had been present had practically disappeared. The ten-month graft had spindle-shaped spaces in the superficial third of its stroma, while the other graft was free from such spaces. In each case, the graft contained more nuclei than normal, and each graft had an epithelial covering.

(2) THE TWO MARGINAL GRAFTS.

These two grafts were taken fifteen days (R.50) and ten months (R.62) respectively after operation, and each graft was opaque. In each case the iris was adherent and there were folds in Descemet's membrane, with new formation of vascularized tissue deep to the membrane. The ten-month graft had blood-vessels in its stroma, supplied from the scleral and conjunctival vessels, as well as from the adherent iris. The nuclear content of the ten-month graft was decidedly increased, while the increase of nuclei in the other graft was slight. There was much loss of epithelium in the fifteen-day graft.

(3) GRAFT CONSISTING OF THE WHOLE OF THE CORNEA.

The graft described (R.3) was taken nineteen months after operation. It may be noted that the iris was adherent at the periphery, but that Descemet's membrane was not folded and had no new tissue deep to it; that the graft was vascularized, particularly in its superficial half, and that there were large, irregular spaces between its fibres. The superficial layers were closely packed together, with many nuclei, and the nuclear content of the graft was much increased. The graft possessed an epithelial covering, which was rather thick.

General Relationship between the Degree of Opacity of the Grafts and the Microscopic Appearances

The seven central grafts and the two marginal grafts will now be considered, and for this purpose will be divided into two Groups:—

(*a*) Seven grafts of two-and-a-half months and more;

(*b*) Two grafts of fifteen days and twenty days respectively.

(*a*) Of these seven grafts, four were opaque, two had nebulous central areas, and one had a central area that was nearly clear. All these grafts had an epithelial covering. Each of the opaque grafts had an adherent iris, folds in Descemet's membrane throughout its extent, new tissue formation deep to Descemet's membrane (which in three cases was definitely vascular), and blood-vessels in the graft.

Of the two grafts with nebulous central areas, one had an adherent iris, neither had folds in Descemet's membrane, neither had new formation of tissue deep to Descemet's membrane except at the periphery, and the centre of each graft was practically devoid of blood-vessels.

The graft with a central area that was nearly clear had no adhesion of the iris, and there was only one small fold in the middle of the Descemet's membrane, with a localized small mass of avascular new tissue at this spot. The few blood-vessels which had been present in the graft had largely disappeared.

Increase in the number of nuclei in the graft was present in each of the four opaque grafts, and in three of them the increase was considerable. A definite increase of nuclei was present in one of the nebulous grafts, while the graft with an area that was nearly clear showed only a slight increase.

Irregular spaces between the graft's fibres were present in three of the opaque grafts, in one of the nebulous grafts, and in the graft with an area nearly clear. In the last two, however, these spaces were only found in the superficial third of the graft.

One of the opaque and one of the nebulous grafts showed a new Descemet's membrane throughout its whole extent. In the former, the new membrane was separated from the old membrane by new tissue, while in the latter the two membranes were fused together in the central area of the graft.

(*b*) Of these two grafts, one had a central area that was nearly clear, and one was opaque. Each had an adherent iris. The opaque graft had folds in Descemet's membrane, and vascularized new tissue deep to Descemet's membrane, whereas the other graft had no folds in Descemet's membrane, and new tissue formation deep to that membrane was confined to the margins.

There was an increase in the number of nuclei in each graft, but the grafts were not yet vascularized. The opaque graft showed much loss of epithelium.

Degree of Swelling of the Grafts

The following observations on the swelling of the graft are of interest in relation to the age of the graft and the depth of opacity present.

Measurements of the graft were made from the surface down to Descemet's membrane and did not include any new tissue deep to Descemet's membrane. Increase or decrease of thickness of the grafts was estimated and is here given in terms of percentage increase or decrease from the average thickness of the cornea in the same eye.:—

(*a*) Two grafts taken at fifteen days and twenty days respectively.

The graft with an area partly clear showed an increase in thickness of 15 per cent., while the opaque graft showed 140 per cent. increase.

(*b*) Three grafts taken at two-and-a-half to three months.

The graft with a nebulous centre showed an increase in thickness of 30 per cent., while the two opaque grafts showed 153 per cent. and 58 per cent. increase respectively—an average of 105 per cent.

(*c*) Four grafts taken at ten to eighteen months.

One nebulous graft showed a decrease in thickness of 66 per cent., and one graft with a partly clear area was the same thickness as the cornea. Two opaque grafts showed increase of thickness of 36 per cent. and 172 per cent. respectively, an average of 104 per cent.

From the above details, it will be seen that a certain amount of swelling of a corneal graft is present at two to three weeks after the operation, and the swelling is more marked in an opaque graft; that these grafts (none of which was perfectly clear) were all increased in thickness (with one exception) at periods varying from two-and-a-half to eighteen months, and that this increase was, on an average, more than 100 per cent. in the case of the completely opaque grafts, but not more than 30 per cent. in the grafts which were not completely opaque. One of the nebulous grafts showed a considerable decrease in thickness at sixteen months.

Conclusions

From the details enumerated in this paper, it will be seen that there is a considerable difference between the microscopic appearances of infected or partly detached corneal grafts and well united grafts. The features of each type have been given and summarised. There are also differences between the microscopic appearances of completely opaque grafts and those of grafts which are partly clear.

Dense opacity of a corneal graft appears to be associated particularly with the following features:—

(*a*) Adhesion of the iris to the graft.

(*b*) Folding of Descemet's membrane.

(*c*) New tissue formation behind Descemet's membrane (often vascularized).

(*d*) Vascularization of the graft from the periphery through the cornea.

(*e*) Vascularization of the graft from an adherent iris.

(*f*) Increased nucleation of the superficial layers of the graft, associated with previous superficial vascularization.

(*g*) Large increase in the nuclear content of the graft.

(*h*) The formation of irregular spaces (sometimes spindle-shaped) between the graft fibres, thus causing irregular refraction and diffraction of light.

(*i*) Relatively large increase in thickness of the graft.

Conversely, the less these factors are present, the more likely is the graft to be clear.

The above conclusions are in accord with the results of the experiments as published (*Lancet*, February 14, 1931). Thus it was noted that an adhesion of the iris to the graft prejudices the result in regard to transparency. It has now been shown that such an adhesion of the iris tends to produce at least four of the features enumerated above, viz.—(*a*), (*c*), (*e*), and (*g*).

It can also be understood how the formation of a gap at one side of the graft (*cf.* partly detached grafts) tends to produce invasion of the graft by cells from without, as well as vascularization of the graft proceeding from the attached end, with consequent impairment of clarity of the graft. Furthermore, the iris is apt to become adherent where there is even a slight partial detachment of the graft, and blood-vessels are very likely to grow in from the iris as well as from the periphery of the cornea.

The swelling of the graft and of the cut margins of the cornea in the early days after operation, which was noted during the performance of the experiments, is confirmed by the microscopic features which have been described. It is worthy of note that this fact has an important bearing on the whole problem of corneal transplantation and was one of the underlying principles accepted in formulating the operative procedure which gave the most successful results.

RESULTS OF INTRANASAL DACRYOCYSTORHINOSTOMY

BY

L. M. JOYCE HENRY,
B.A., M.R.C.S.Eng., F.R.C.S.Edin.

(From the Eye Department of the Royal Infirmary, Edinburgh, under the charge of A. H. H. SINCLAIR, M.D., F.R.C.S.Edin., *and* E. H. CAMERON, M.B., F.R.C.S.Edin., *and the Ear and Throat Department under the charge of* J. S. FRASER, M.B., F.R.C.S.Edin.*)*

THIS investigation has been carried out in order to test the results obtained by West's operation on the tear sac. During the years 1915 to 1931 (inclusive) 108 such operations have been performed by Dr. J. S. Fraser at the Royal Infirmary, Edinburgh. Of these 108 cases, 77 who live within reasonable distance of Edinburgh were asked to report during July and August, 1932, but only 23 responded. Of these 23 cases four had had bilateral operations, thus giving a total of 27 tear sac operations. Eighteen of the 23 patients were females.

The results of the West operations were studied from three aspects:—

1. Clinical, *i.e.*, the patient's statement regarding her or his condition.
2. Functional efficiency of the new passage from conjunctiva to nose, as tested by the fluorescein test.
3. Bacteriology of conjunctiva: the object here was to ascertain whether the operation could be used for "sterilization" of the conjunctival sac before cataract extraction or other intra-ocular procedures.

1.—Each patient was asked whether she had any watering of the eyes, purulent discharge or other eye trouble: and if the reply was "No" the leading question "Not even in the wind?" was added. Only those cases answering "No" to both questions were put down as fully cured.

	Per cent.
(*a*) Perfect results—no epiphora, 21	78
(*b*) Imperfect results: epiphora in cold wind, 3	11
epiphora in bright sunshine, 1 ...	3·7
(*c*) No improvement—1 case (bilateral operation) ...	7·4

The last patient apparently had suffered from watering of both eyes from birth and, though the lacrimal passages were patent, had

had the canaliculi slit, without result, before West's operation was performed.

2.—*Fluorescein Test.*—This is perhaps mainly of academic interest, for of the four patients showing complete impermeability to the dye, three had no watering of the eyes and the fourth was the congenital bilateral case mentioned above.

Two of the cases showing "some delay" had watering of the eyes in the wind.

	Per cent.
(*a*) Perfect: dye reaches nose in less than two minutes, 19	70·4
(*b*) Imperfect: some delay (2-4 minutes), 3	11·0
(*c*) Failure: dye does not pass at all, 4 (one bilateral as above)	18·6

3.—*Bacteriology.*—A swab was taken from the conjunctiva and incubated on fresh blood-smeared agar for two days. Where necessary for purposes of identification, the culture was re-sown on other media. Four conjunctival sacs gave a growth of streptococci, with or without other (innocuous) germs (three of these were cases showing no epiphora and no delay in the fluorescein test, while the fourth had epiphora in a cold wind). No pneumococci were found in this series in spite of the fact that the culture medium chosen was that on which pneumococci grow most readily. Four conjunctival sacs showed Xerosis or coliform organisms (in three of these the drainage was poor or absent, as shown by the fluorescein test, though in all four cases there was complete clinical cure).

Thus only four out of twenty-two eyes examined (five cultures, mostly from "clinical cures" were missed by accident) showed a potentially injurious flora—a "sterilization" rate of 82 per cent. This compares favourably with a bacteriological success-rate of 57 per cent. after external operation, as found by Mattice in Axenfeld's clinic[1]. Bumke and West[2] found that "pathological bacteria disappeared from the conjunctival sac within one or two days after West's operation"— a statement which seems to imply that the immediate (though possibly impermanent) "cleaning up" effect is constantly found. In addition, as Kofler and Urbanek[3] point out, an external scar and the risk of keloid formation are avoided by West's operation.

Summary

1.—Twenty-three cases (four after bilateral operation) were investigated.

2.—A perfect clinical result was obtained in 78 per cent. (compared with 73 per cent. in 1925[4]).

3.—The fluorescein test may apparently show obstruction in cases with no epiphora and therefore is not of great practical importance.

4.—Sterilization of the conjunctival sac as regards streptococci and pneumococci was obtained in 82 per cent.

REFERENCES

1. Quoted by **West** in "Clinical Results of Intranasal Tear-sac Operation." *Trans. Ophthal. Amer. Med. Assoc.*, pp. 69-81, 1931.
2. *Ibid.*
3. **Kofler and Urbanek.**—Zur Vereinfachung und Verbesserung der West—Polyak'schen endonasalen Tränen-sackoperation. *Wien. Med. Wochenschr.*, Vol. LXXVIII, p. 632, 1928.
4. **Paterson and Fraser.**—*Brit. Jl. of Ophthal.*, May, 1919.
Fraser.—Intranasal Dacryocystostomy. *Jl. of Laryngol. and Otol.*, Vol. XL, pp. 725-729, 1925.

A HAND SLIT-LAMP

BY

N. BISHOP HARMAN

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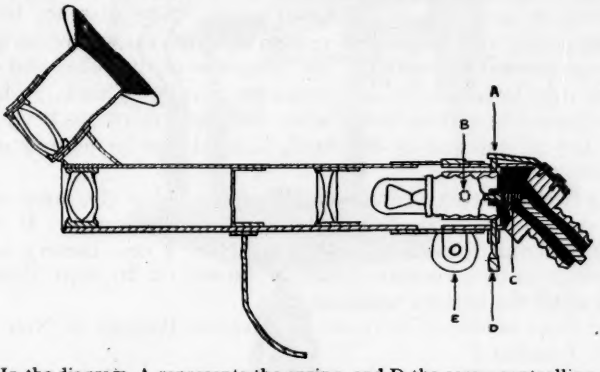
THE value of the standard forms of slit-lamps for certain ophthalmic investigations is undoubted. But the immobility of these large instruments limits their use to the consulting room and clinic.

The hand slit-lamp shown has been devised with the intent of securing an instrument that could be used as readily and as easily as an electric ophthalmoscope; so that it can be carried about, and used with ease for the examination of children, and patients in bed or in their own homes. It cannot, by reason of its small size, compete with the large instruments in magnification and in resolution of fine detail. Yet it will secure a valuable view of the media of the eye as deep as the anterior part of the vitreous. The small lamp as compared with the large might be said to have something like the relation of two-thirds inch objective of the microscope to the one-sixth inch objective. But the small lamp gives the same effect of depth as the large lamp, so that its value for localization is certain.

The lamp is fitted to the battery handle of an electric ophthalmoscope; or a small adapter can be supplied with leads to a torch battery or other suitable source of current. At the upper end, set at right angles to the ophthalmoscope handle, is an eyepiece consisting of a triple achromatic lens giving a linear magnification of 12 X. The lens holder is so made that other powered lenses can be substituted. The case of the eyepiece is graven with a

scale so that the focus of the lens, once found, can always be recovered.

Below the eyepiece, and at an angle of 45° to it, is the projection combination, forming a horizontal slit of light at a distance of one inch. It comprises a gas-filled lamp with a single strand filament, made for two-cell or three-cell dry batteries. The centre pole of the lamp abuts on to a spring contact, so that all lamps can be set with the filament horizontal. A powerful condensing system produces an image of the filament upon a slit fixed in the



In the diagram, A represents the spring, and D the screw controlling the lamp centre. B indicates the position of the trunnion, C the centre contact of the lamp, and E the clamping screw. Note that in practice the filament and slit are horizontal.

tube, so that the projection lens, an achromatic lens of some 60 dioptres, can form a clear image of this slit, free from disturbing haze or filament irregularities.

In use, the instrument must be kept steady in relation to the eye of the patient, and yet allow focusing for depth. This can be obtained by the following manoeuvre. The lamp is held by the main tube with the battery handle or adapter hanging down. There is a trigger-like spur projecting below the main tube, and this lies conveniently between the second and third fingers. The thumb rests on the top of the tube, with its end in the angle between the tube and eyepiece, the forefinger lies along the side, so that the projecting tip of the finger can rest against the patient's cheek at the lower border of the orbit. This contact gives steady support. Alternate crooking and straightening the forefinger brings the lamp nearer or further from the eye and gives focusing for depth.

Adjustments of the instrument are of the fewest, normally the eyepiece alone is likely to require setting. But the setting of the

lamp bulb, in case of replacement, needs attention. The filament must be horizontal and in the axis of the system. Whether or no this adjustment is correct, can be seen by looking at the face of the projection lens. The bright line of light should cut the lens horizontally into two equal parts. If this line is not true, the position of the filament must be altered. The lamp mount is pivoted at its front end on a horizontal axis on trunnions. At the back there are a screw and a spring on a vertical axis, the one lifting the back, the other allowing it to fall. As the back rises, so the filament is lowered, and *vice versa*, the movement being made by releasing or screwing in the lower screw. The distance between the lamp and the condenser system can be varied by loosening the large headed screw under the lamp end of the tube, and allowing the tube to slide over the lamp stem a little. This large-headed screw should be turned firmly when the adjustment has been made. Once the adjustment is obtained, it need not be altered until a new lamp is required.

It is better not to wear spectacles when using the lamp so that one's eye can be well within the shield of the ocular. It is well not to over-run the electric bulb, so when a new battery is used the switch to the rheostat should be turned on no more than two-thirds until the battery weakens.

The hand slit-lamp is made by Messrs. Rayner of New Bond Street, London.

A NEW SLIT-LAMP

BY

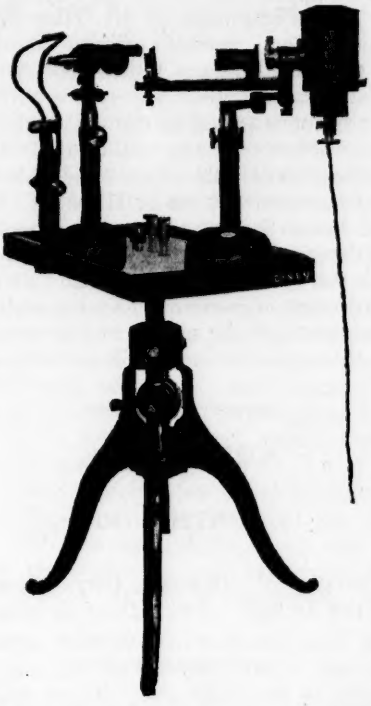
E. GORDON MACKIE

SHEFFIELD

THE Slit-lamp has not hitherto been so widely used as its undoubted merits deserve. This is no doubt partly due to its many complicated adjustments which necessarily increase the cost of the apparatus. Quite a number of these are but rarely used in working the lamp, and some of them can be rendered unnecessary and expense saved by improvement in design. Its real value can only be appreciated by regular use and with the hope of inducing more of my colleagues to adopt this aid to their work I venture to bring to their notice the instrument here illustrated.

It has been made in accordance with the above ideas and having now been in use for over eighteen months and satisfied certain experienced slit-lamp observers may be said to be more than an experiment.

The light source is a "Home Cinema Projection Lamp," used direct on the house current without resistance, and stocked by most electrical dealers. The optical system selects one of the filaments of the lamp grid and projects it in the Vogt manner, the beam being controlled by an adjustable slit, fine adjustment focussing screw and Arruga (vertical) screw in the ordinary manner. The selection of the filament is made in mounting the lamp in its



housing; the selected position is maintained by two clamping screws and remains indefinitely. A feeble light is a source of much unrewarded slit-lamp observation, and replacement of the old Nernst lamp by the Nitra lamp (of thrice the light value) was a landmark in the history of the instrument. Taking the latter lamp as a standard, the system adopted has been found to give 91 per cent. of the light value from a Nitra source at the point under examination, and this is fully adequate for all clinical purposes. For special purposes certain workers may require the

highest degree of illumination obtainable, and this is now provided for by an alternative lighting system which, however, necessitates the use of a rheostat. The lamp and microscope are alike mounted on bases to slide on the glass-topped table. This method is less speedy than a mechanical device for lateral transit of the lamp, but it affords greater steadiness, and when the beam is adjusted it does not tend to pivot off its mark, so that there is no need to hold it constantly in position.

The beam can be applied all round the stand and I am obliged for a suggestion to this end made by Mr. Harrison Butler.

The microscope affords a flat field and the magnification of ×20 has been chosen as that of greatest usefulness for standard supply. Other magnifications are available (preferably by additional objectives), but are not required in routine work. If it is desired to study the endothelial cells the addition of objective 32 mm. provides a magnification of ×28 which is suitable for this purpose.

The instrument was made for me by Messrs. C. W. Dixey & Son Ltd., of 15, Old Bond Street, who were responsible for many devices for simplifying mechanical design and for the successful means of cooling the 100 Watt lamp. I am indebted to them for much painstaking work, experiment and ingenuity. As the complete instrument costs half the usual price it may permit of more extended use of this valuable means of ocular examination.

ABSTRACTS

I.—PATHOLOGY

(1) **McKee, Joseph W. (Kansas City, Missouri).—Melanosarcoma at the limbus.** *Amer. Jl. of Ophthal.*, May, 1930.

(1) **McKee's** case was that of a woman, aged 31 years, who, when first seen, had a small deposit of pigment at the temporal side of the limbus in the right eye. There was a history of a similar deposit having been removed from the same area six years previously. Within six months, the pigmented area had become a soft, lobulated, almost black growth involving a quarter the circumference of the cornea. With the slit-lamp, it could be seen to be infiltrating the cornea. An application was made with the thermophore at 146° F. for two minutes, and a month later a second application was made to the area not covered by the first one. Within three months all traces of the tumour had disappeared, and there has been no recurrence over a period of three years, vision remaining 20/20.

F. A. W-N.

(2) **Lugli (Bologna).—Cancer of the sebaceous glands of the lid margin. (Sul cancro delle ghiandole sebaceo del bordo palpebrale).** *Boll. d'Ocul.*, January, 1932.

(2) In Lugli's case the tumour was situated in the outer third of the right lower lid. Histological examination showed that the starting point was in the epithelium of one of the sebaceous glands. There are few similar cases reported.

HAROLD GRIMSDALE.

(3) **Levine, Joseph (New York).—Acquired cyst of the optic disc.** *Arch. of Ophthal.*, August, 1932.

(3) Levine reports an interesting case of this type occurring in a girl, aged 14 years, who had pigmentary degeneration of the retina. A grey cystic tubular mass was seen protruding from the nasal margin of the disc. The cyst in the course of time became longer and thinner and developed a daughter cyst. There was no other disease present and the author considered that it was an early manifestation of tuberous sclerosis or was coincident with the retinal disease. The former was the more likely diagnosis but time would have to elapse before this could be established because up to date no other signs were present. Tuberous sclerosis consists in the development of glial nodules on the surface of the brain and similar proliferative masses in other parts of the body, *e.g.*, the skin (adenoma sebaceum), the cutaneous nerve fibres (neurofibromatosis), the heart, the thyroid gland and the breasts. In the eye, two forms are recognized, raised tumour masses of the disc, and flat tumours of the retina. They are thought to arise from retinal cells which have failed to differentiate during the process of development. The fact that the cyst arose from the optic disc is evidence against its being due to pigmentary degeneration of the retina though small accumulations of neuroglia cells have been found by Verhoeff in the disease, also small cysts.

F. A. W-N.

II.—OPTICS AND REFRACTION

(1) **Granström, K. O. (Stockholm).—Studies in monocular high myopia. (Studien ueber einseitige, hochgradige Myopie).** *Acta Ophthal.*, Vol. X, p. 348, 1932.

(1) Granström analyses fifty-cases of monocular myopia of not less than 5 D. He reports:—

1. The corneal refraction in the myopic and the non-myopic fellow eye was generally equal, though the myopic eye frequently showed rather more physiological astigmatism.

2. The tension was likewise about equal in the two eyes. In some cases it was rather lower in the myopic eye; only exceptionally was it higher.

3. Corneal scars were more frequent in the myopic eye—whether the cause of myopia or an expression of the greater proneness of myopic eyes to disease, could not be determined.

4. The myopic eyes showed the usual fundus changes; not so the non-myopic eyes.

5. Divergent squint in the myopic eye was fairly common.

6. Obvious facial asymmetry was not observed.

7. There was no noticeable inequality of the pupils.

8. No conclusive evidence on heredity could be collected.

ARNOLD SORSBY.

(2) **Gualdi (Florence).—The technique and practical results of the application of contact lenses, with special regard to the correction of ametropia. (Tecnica e risulta i della applicazione practica dei vitri aderenti arrotati con speciale riguardo alla correzione delle ametropie).** *Boll. d'Ocul.*, November, 1932.

(2) In this long and interesting paper **Gualdi** discusses the use of contact lenses, of which he is a strong advocate. He describes, with illustrations, the method which he employs to introduce the glass so as to avoid the presence of air-bubbles, and their removal. He gives the history of a number of patients for whom the use of such lenses was of assistance. Finally, he examines how the use of contact lenses may be best generalized. He decides that there are two requisites, to reduce the cost of the lenses, and to make available to all ophthalmologists a small but sufficient series of test lenses. Practically, he says we have to consider only the scleral curvature; this varies from a radius of 10·5 mm. to 13 mm. Six trial lenses should be obtained with curvatures at each 0·5 mm. between these limits; the edges must be well rounded and smoothed. When the surgeon has decided which of these best adjusts itself to the patient's eye, he finds the additional correction which is necessary and writes the prescription accordingly, giving the internal curvature of the trial lens and the additional correction.

HAROLD GRIMSDALE.

(3) **Prister, Bruno (Trieste).—Contact lenses and a model of the anterior segment of the eye. (I vitri adesivi ed el calco del segmento anteriore del bulbo).** *Boll. d'Ocul.*, February, 1933.

(3) Though the subject of contact lenses has been fully discussed of recent years, and their form and refracting power worked

out in detail, they remain outside the orbit of most ophthalmic surgeons on account of the cost; at least 100 are required as test glasses. It would simplify matters if the curvature of the anterior segment of the eye were readily and accurately obtainable. The curvature of the cornea can be measured by the ophthalmometer, but the curvature of the sclerotic is at least as important; **Prister** suggests that it may be possible to take a mould of the anterior segment in dental wax. To this end he has devised an instrument to carry a thin, oval plate of wax. After preliminary cocainization, the lids are held apart and the oval plate slipped under the upper lid and pressed gently on the globe. By means of pads of cotton wool dipped in hot water, the wax is kept soft and moulded to the surface; when the surgeon is satisfied that he has a useful mould, the wax is hardened by cold swabs and the carrier removed from the eye. It is not always easy to remove the carrier without altering the mould, but with practice it can be done. From this negative a model of the segment is cast in plaster. Prister recommends that two casts be taken and that one should be varnished to give a reflecting surface. From this it can be judged how closely the cast approaches the ocular curvature. The contact glass can be made from the cast.

HAROLD GRIMSDALE.

(4) **Vita (Turin).—On the modification of size and form produced by glasses. (Sulle modificazioni di grandezza e di forma dello spazio ottico soggettivo prodotte dagli occhiali).** *Rass. Ital. d'Ottal.*, September-October, 1932.

(4) In this long and interesting paper **Vita** discusses the alterations of the size of the retinal images produced by optical corrections and the accompanying changes in shape and position of external objects. He shows that the view often taken, that with glasses placed so that the distance between the anterior principal point of the eye and the correcting lens is equal to the anterior focal distance of the eye, the image formed is equal in size to the image formed by an emmetropic eye, and that, therefore, there is no alteration of apparent size by correction, is not true; the images formed by a myopic eye, though not distinct, are necessarily larger than those of an emmetropic eye. When the myope is corrected he finds objects appearing smaller than before. Vita points out that it is possible by the use of telescopic spectacles to adjust matters so that the image formed on the myope's retina is of the same size as before correction, but is distinct instead of being blurred.

HAROLD GRIMSDALE.

III.—THERAPEUTICS

(1) **Gay, Leslie N. (Baltimore).—The treatment of ocular tuberculosis with tuberculin.** *Arch. of Ophthal.*, March, 1930.

(1) **Gay's** paper gives the results of tuberculin treatment at the Wilmer Institute in a group of 30 patients, who had been unsuccessfully treated by other methods: 15 had uveitis, 8 keratitis, 1 nodular scleritis, 1 iritis, and 5 recurrent intra-ocular haemorrhages. The results were "most gratifying," and are given in a series of tables. In the early part of his paper the author quotes Wilmer's description of the three types of ocular tuberculosis: (1) Uveitis with mutton-fat K.P., vitreous opacities, macular lesions and sometimes exudate on the lens. (2) Where the lesion is confined mostly to the posterior portion of the uvea, and appears as large yellowish white spots of exudate surrounded by retinal haemorrhages and ultimately becoming fibrous. (3) Recurrent vitreous haemorrhages in young patients often with subsequent retinitis proliferans. Diagnosis was made by intradermic injections of old tuberculin, a control injection also being made of the culture medium. The site of the injection was on the forearm near the wrist, and 0·1 c.c. of a 1 : 100,000 dilution (*i.e.*, ·001 mg.) was used. If no reaction occurred within 48 hours 0·1 c.c. of a 1 : 10,000 dilution (·01 mg.) was given, and if this was ineffective increasing amounts were given, up to a total of 1 mg. The degree of sensitiveness does not necessarily indicate the severity of the disease, but in the average patient more significance is attached to a reaction from the weaker solutions, 0·001 mg. and 0·01 mg., than to a reaction from the strong solutions. Treatment is carried out with bouillon filtrate, prepared by the method of Denys (Le bouillon filtré, Paris, 1925), since bacillary emulsion is not susceptible of accurate dosage in the weaker dilutions. The initial dose is 0·000001 mg. injected into the deltoid muscle. The injections are given twice weekly until a concentration of 1 mg. per c.c. is reached, when they are given once a week, the dosage being gradually increased up to a maximum of 100 mg. over a period of six to ten months. If a focal reaction appeared after any injection, it was taken as an indication for reducing the dose, and as a result of this, no patient was made any worse by the treatment. In the majority of cases, the result has been the restoration of an eye or eyes supposedly beyond repair. An interesting observation made on 25 of the patients was that in only nine of them was there any appreciable change in the sensitivity of the skin to tuberculin.

F. A. W-N.

(2) **Benedict, William L. and Goeckerman, Williams H. (Rochester, Minn.).—Foreign proteins and gold in the treatment of uveitis.** *Arch. of Ophthal.*, August, 1932.

(2) **Benedict** and **Goeckerman** in this article give an account of the treatment of uveitis at the Mayo Clinic and state that the majority of cases are recurrent and chronic, often of indeterminate origin and hence must be dealt with by systemic treatment. The most satisfactory methed of treating acute cases is to inject 6 to 10 c.c. of boiled milk into the gluteal region, a second injection not being given until 24 hours after the subsidence of any pyrexia induced by the first one. In cases where a low grade uveitis has continued for over a month and not more than three months, milk injections have not been of value. Typhoid vaccine, subcutaneously or intravenously has been used in these cases, dosage being kept at a constant level of 25-50 million or stepped up rapidly to 500 million, since this sometimes promotes quicker healing. In uveitis of longer duration than three months, prolonged treatment is required and patients will not stand repeated bouts of artificially induced pyrexia. In such cases, the authors have been trying the effect of sodium gold thiosulphate, given intravenously in doses of 10-100 mg. two or three times a week, the average dose being 25-50 mg. Fifty or sixty injections are usually given, the drug is then discontinued for one or two months and a second course of fifty or sixty injections is administered. The mode of action of gold is not understood, but one hypothesis is that it produces peripheral capillary hyperaemia by paralysing the contractile cells of the capillaries. Care must be exercised in its employment and one case was reported in the discussion of this paper, in which after the administration of an injection of sodium gold thiosulphate, a violent reaction resulted, with the formation of numerous papules. Some of these were on the corneae and became infected with resulting panophthalmitis and loss of both eyes. The authors do not regard this agent as a cure all, but it certainly has a beneficial effect in some cases which are untouched by other methods of treatment.

F. A. W-N.

(3) ***Tirelli* (Turin).—Treatment of tabetic optic atrophy by sulphur therapy. (Sulla cura dell'atrofia tabetica del nervo ottico con particolare riguardo alla zolfopiretoterapia).** *Rass. Ital. d'Ottal.*, May-June, 1932.

(3) The treatment of optic atrophy in tabetics is so unsatisfactory that any means is justifiable which holds out any real prospect of success. The treatment of general paralysis by causing an attack of malaria has proved useful in a number of

cases, but has not succeeded in tabetics. There seems, however, no reason to doubt the good effects of high temperature in killing the spirochete. Hence trials have been made of various methods of inducing fever in tabetics in the hope of improving their condition. Since Schröder in 1927 published a paper on the results which he had obtained by the injection of a suspension of sulphur in olive oil, others have experimented with this or some similar remedy. Tirrelli reports five cases in whom the usual specific treatment was accompanied by these injections. In three there was enlargement of the visual field and increased visual acuity. In one only, in whom the condition was far advanced, was there no success.

HAROLD GRIMSDALE.

(4) **Pergola (Turin).—Tripaflavin in septic infections of the eye. (Sulla terapia acridinica dei processi settici dell'occhio).** *Lett. Oftal.*, August, 1932.

(4) **Pergola** has used tripaflavin in a number of cases of hypopyon ulcer and in some other infections. He advises its use by intravenous injection with a dose of 5 c.c. of 0·5 per cent. solution. These injections are given every other day. He finds that the hypopyon is absorbed with great rapidity.

HAROLD GRIMSDALE.

(5) **Montanelli (Pistoia).—The action of phenol in subconjunctival injection. (Sull'azione del fenol per iniezioni sottocongiuntivali, nell'occhio).** *Lett. Oftal.*, November, 1931.

(5) In a case of repeated vitreous haemorrhage which recurred after other treatment **Montanelli** determined to make use of counter-irritation, and with this aim injected subconjunctivally 0·5 c.c. of 1 per cent. solution of phenol. The result was satisfactory in that there was no further return of haemorrhage, but the injection gave rise to intense pain which lasted for some days. The author attempted to explain the unexpectedly brilliant result by experiments on rabbits. The animals did not appear to suffer in any degree comparable to the subject of the paper. Examination of their eyes after enucleation showed very little change in most of the parts of the eye. There was a temporary marked dilatation of the vessels of the iris and a great movement of chromatophores into the tissue of the iris and ciliary body. The deeper structures were entirely unaffected.

HAROLD GRIMSDALE.

(6) **Pergola (Turin).—Pantocain in ocular anaesthesia. (Sul valore della pantocain nella anestesia oculare).** *Rass. Ital. d'Ottal.*, July, 1932.

(6) **Pergola** finds pantocain an almost ideal local anaesthetic. It is not toxic to any extent; it produces good anaesthesia of the cornea when dropped into the eye and has no effect on the pupil or tension. It is inferior to cocaine in producing anaesthesia of the ocular conjunctiva and of the lacrimal passages.

HAROLD GRIMSDALE.

IV.—MISCELLANEOUS

(1) **Alpers, J. Bernard, Wolman, I. J. (Philadelphia).—Arterio-sclerotic disease of the optic nerve.** *Arch. of Ophthal.*, July, 1931.

(1) **Alpers'** and **Wolman's** paper opens with a short résumé of the literature on this subject from which it appears that the first case was described as long ago as 1877. Arterio-sclerosis may affect the nerve by direct compression exercised by arteries in its proximity, or by sclerosis affecting the vessels in the nerve itself. In some cases there is a combination of these two factors and the one reported falls into this class. The patient was a woman, aged 44 years, who had had hyperpiesis for some years. Three years previously the right eye had shown swelling of the disc and a star-shaped exudate in the macular region. Shortly before death, however, the fundi were reported as normal, except for narrowing of the arteries which showed no sign of sclerosis. Post-mortem: there was intense sclerosis of the circle of Willis; the optic nerves were compressed by the internal carotid arteries, the nerve in one portion being flattened out almost to a ribbon, while the brain was markedly oedematous.

A review of the cases previously reported shows that compression of the nerves may occur in three different places: (1) in the fibrous prolongation of the optic foramen, through pressure by the ophthalmic artery; (2) at the upper edge of the fibrous canal through pressure of the internal carotids; and (3) between the canal and the chiasma where the internal carotid and anterior cerebral arteries cross the nerves. In many cases, there is aneurysmal dilatation of the affected vessel and retinal arterio-sclerosis is usually absent. Clinically, there may be optic atrophy with marked loss of vision, or no atrophy and only a scotoma or some decrease in visual acuity.

F. A. W-N.

(2) **Villaret, M., Justin-Besancon, L., Schiff-Wertheimer, Gallois, J. (Paris).—The esters of choline in ophthalmology. (Les Esters de la Choline en Ophtalmologie).** *Arch. d'Ophtal.*, March, 1932.

(2) A long period elapsed between the physiological and pharmacological investigation of the esters of choline and their employment as therapeutic agents. In 1926, for the first time, **Villaret, Justin-Besancon, Schiff-Wertheimer,** and **Gallois** made use of acetyl-choline in the treatment of Raynaud's syndrome. The paper now published embodies their account of a prolonged research, the results of which, in experiments on animals and in the administration of the drug in man, are reported in considerable detail. References are made to recent clinical observations on the use of the esters of choline in ophthalmological practice, published in France, Italy, the Argentine and Turkey. The authors' conclusions read as follows:—

The physiological and pharmaco-dynamic researches which have served as the foundation for the therapeutic employment of the esters of choline, and especially of acetyl-choline, enable us, in some degree, to foresee and direct their clinical utilization. The selective action of this drug on the peripheral arteries, would lead us, *a priori*, to consider it a medicament of choice in affections in which vascular spasm is an important factor. Our experiences in the human subject, by examination of the retinal artery, have established the dilating action on arterioles of acetyl-choline administered subcutaneously. This artery has proved extremely sensitive to the drug. This is also apparent in the clinical reports of other observers. Acetyl-choline, obviously, cannot exert a favourable action in arterial obstruction if the obliteration of the vessels is complete. For this reason the most satisfactory results are obtained in ophthalmology: (1) in cases of hypertonus, or of vascular lesions, often visible, in which arterial spasm suddenly obstructs a vessel already diseased; and (2) in young subjects, free from any cardiac lesion, in whom tonicity of the arterial walls seems to be an essential factor in the mechanism of obstruction. We have found also that the dilating action of acetyl-choline on arterioles proves useful in glaucoma, and that tolerance of the drug is such as to allow its prolonged employment in chronic cases.

We are unable at the moment to report observations concerning the therapeutic value of other derivatives of choline, such as α-methylacetylcholine, which are still in the experimental stage.

J. B. LAWFORD.

(3) **Colrat, A. (Lyon).—Congenital bilateral paralysis of horizontal movements of the eyes. (Paralysie bilatérale des mouvements de latéralité des yeux d'origine congénitale).** *Arch. d'Ophtal.*, December, 1931.

(3) **Colrat** publishes clinical notes of a case of great rarity. He is aware of only three other records by Jacqueau, Fryer and Sauvineau respectively. The author's patient was a female child, aged 2½ years, who exhibited complete loss of the power of rotation of the eyes to the right or the left. Vertical movements and convergence were practically, but perhaps not absolutely, normal, and no other abnormality was discovered. The child was healthy—the offspring (and fifth child) of first cousins. The history seemed to indicate that in the first months of life there had been loss, or gross defect, of vertical movements.

Various hypotheses have been offered to explain this congenital defect; Colrat favours bilateral lesions of the sixth pair of nerves, or of their connection with the posterior longitudinal bundle. Congenital absence of lateral movement of *one* eyeball, a less uncommon defect, is probably due to peripheral muscular and aponeurotic anomalies.

J. B. LAWFORD.

(4) **de Martel, T., Monbrun, Guillaume, J.—The prognosis concerning vision in those operated on for tumour in the hypophyseal region. (L'avenir ophtalmologique des opérés de tumeurs de la région hypophysaire).** *Arch. d'Ophtal.*, August, 1931.

(4) In this interesting and valuable communication **de Martel Monbrun** and **Guillaume** present the evidence obtained from patients who had undergone operations for new growths in the hypophyseal area. The patients were kept under observation, and the results of late examination furnish a basis for fairly definite conclusions regarding the prospect, in such cases, of retention or recovery of useful sight. Five cases are reported in detail: they are worthy of study. The clinical notes are amplified by charts of the fields of vision, mapped before and after operation.

In four of the cases "the visual functions, of at least one eye, have again become normal or approximately normal, after intervention, and have been maintained. This result is attributable to operation at an early stage."

While observation shows that the vascular supply of the optic nerves appears to be re-established equally in both, recovery of vision has occurred only in the nerve in which the pallor noticeable before operation, was unaccompanied by actual atrophy.

The fifth case was one in which atrophy of the two optic nerves

had reached a fairly advanced stage before treatment was undertaken. Recovery could be but partial, but it was relatively considerable: the right eye, which had only hand-movement, regained 2/10 vision; the left, which apparently had no perception of light, regained 1/10 vision. The authors express the opinion that the outlook concerning sight in tumours of the hypophyseal region treated surgically, is hopeful. Medical measures are of no avail in preventing progress to blindness. Radio-therapy has proved beneficial in certain cases, but its action is essentially transitory. Three of their cases support this contention. Operative intervention in an early stage is essential, if irreparable damage to sight is to be avoided.

J. B. LAWFORD.

(5) **Teulières, M. and Beauvieux, J. (Bordeaux).—The zonule in vertebrates. (La Zonule chez les vertébrés).** *Arch. d'Ophtal.*, July, 1931.

(5) This paper contains the record of a prolonged and comprehensive investigation into the anatomical features of the zonule of Zinn. Beginning with fish, the researches were pursued through the different groups of vertebrates up to the quadrumana, of which latter class the orang-outang and the chimpanzee were selected for examination. A number of illustrations, some coloured, aid in the description of the specimens. This, the first part of the article, does not lend itself to condensation.

In the second part, **Teulières** and **Beauvieux** provide a lengthy discussion of their findings, under two headings.

(*a*) ***The suspensory or retaining rôle of the Zonule.***—No doubt arises as to this function; the lens is maintained in the fossa of the vitreous by the constituent strands of the zonule, but their arrangement varies considerably in different classes of vertebrates. In fish, the zonule, triangular or quadrangular in form, is placed at the upper part of the lens. It is clear that this support alone would be insufficient to maintain the lens *in situ*, were it not supplemented by firm adhesions between the hyaloid and the posterior surface of the lens. In all classes except fish, the zonule is perilenticular, and although exhibiting variations in form, is composed of fibrils, arranged in bundles, in several planes, running parallel (birds, mammiferae) or crossing each other (apes, man).

The zonule is invariably independent of the vitreous body. The authors designate the triangular space it occupies as the "zonular chamber."

The resistance of the strands of the zonule varies directly as the volume of the lens which they support. In some species, *e.g.*, birds of prey, certain rodents, ruminants, etc., the lens is very large in proportion to the size of the eyeball. Here the zonular fibres are

thick, grouped in solid bundles, and are inserted at or in the immediate vicinity of the equator of the lens.

In the apes the anterior and posterior fibrils of the zonule which extend well on to the surfaces of the lens doubtless aid in suspension, but this function devolves mainly upon the middle fibres which are attached to the equatorial region of the lens.

(*b*) *Rôle of the Zonule in Accommodation.*—The authors consider this question solely from the anatomical standpoint, and ask:—Is the zonule, by reason of its morphology, its relations, its form and its insertions capable of modifying the shape of the lens, in vision for near objects? In fish the answer is in the negative; the action of the zonule being suspensory only. In reptiles, batrachians and birds, the close approximation of the base of the processes to the anterior equatorial edge of the lens is an important anatomical feature. The contact is close and renders it probable, as maintained by Hess, Huxley and Ovio, that accommodation in these animals is effected by alteration in the shape of the lens by pressure of the processes apart from contraction of the ciliary muscle, and that the action of the zonule is of little importance.

The mammiferae, according to the researches of Hess and Ovio, possess little power of accommodation. These writers state that in the cat it is not more than 2 dioptres, in the dog and wolf 1·5 dioptres, in the rodents still less, and in the horse, cow, and sheep almost *nil.* The authors believe that their anatomical study furnishes an explanation of the deficient accommodation in these groups. The suspensory ligament is circular, composed of bundles of fibrils whose thickness and solidity are in proportion to the mass of the lens which they maintain in position. Its insertion is at the equator of the lens and its immediate vicinity. This is the important anatomical fact, and the result is that the effect of traction by these fibrils upon the shape of the lens is almost *nil.* In this group the zonule is much more a maintaining structure than one assisting in accommodation. In monkeys, in contrast to the above, the zonule plays an active part in accommodation. Here the suspensory ligament is identical with that in man. Its wide attachment to the lens, not limited to the edge, but extending far on to both surfaces renders it easy to comprehend the effect of its relaxation or tension upon the capsule, and secondarily upon the lens. The anatomical arrangement shows that in the monkey, as in man, the zonule is an indispensable structure in the function of accommodation. A power of accommodation of 8 to 10 dioptres has been found in the quadrumana (Hess and Heine). The ciliary muscle and zonule are, as in man, closely associated anatomically and physiologically, while in other classes of vertebrates near vision is accomplished by the combined action of intra-ocular muscles and ciliary processes, or it is almost non-existent.

This is a paper worthy of perusal.

J. B. LAWFORD.

(6) **Heinonen, Oskar (Abo).—Observations on Leber's disease. (Beobachtungen bei der Leberschen Krankheit).** *Acta Ophthal.*, Vol. X, p. 201, 1932.

(6) Heinonen reports detailed investigations of a family of five brothers and one sister in which all the brothers were affected by Leber's disease. Four of the five were already affected when seen in 1917; the fifth developed the condition in 1925. Apart from typical features the author points out that more or less marked characteristics of disturbances in the neuro-endocrine apparatus were present in the men. Thus they showed: small stature, akromicry, corpulence, heavily pigmented skin, under-development of hair on the chest and upper extremities, abnormal finger-nails, small penis; as also neurological symptoms such as headache, vertigo, insomnia, profuse sweating, tremor, dermographia and in one case abnormal sella turcica and lowered sugar tolerance.

ARNOLD SORSBY.

(7) **Kestenbaum, Alfred (Vienna).—Topical diagnosis in hemianopsia. (Zur topischen Diagnostik der Hemianopsie).** *Zeitschr. f. Augenheilk.*, Bd. 76, S. 241, 1932.

(7) Kestenbaum reviews the various means employed for localizing the site of hemianopic defects, the hemianopic pupil reaction, Behr's syndrome, and disturbances in adaptation amongst others. He draws attention to the value of optokinetic nystagmus in this connection and gives the results obtained in 22 cases in which the diagnosis was confirmed anatomically, by operation or by undoubted neurological evidence. The visual path is regarded as consisting of five parts: (1) optic tract to pupillary fibres; (2) external geniculate body; (3) beginning of optic radiations; (4) radiations in parieto-temporal area; (5) calcarine fissure. It is mainly in (4) that changes in the character of optokinetic nystagmus occur. Changes of less marked nature occur in hemianopia caused by lesions in the parts of the tract.

ARNOLD SORSBY.

(8) **Grandström, K. O. (Stockholm).—Tularemia oculoglandularis.** *Acta Ophthal.*, Vol. X, p. 237, 1932.

Junius, Paul (Bonn).—Tularemia—conjunctivitis Parinaud. *Zeitschr. f. Augenheilk.*, Bd. 78, S. 142, 1932.

(8) Tularaemia is an animal disease, the transmissibility of which to man has been recognized since 1914 (Vail). Four forms are described: (1) the most common, ulcero-glandular variety with papillary masses at the site of infection—generally the hands—

and swelling of the local lymph glands associated with marked malaise, fever and slow convalescence; (2) the glandular form—not showing any primary wound; (3) the typhoid type in which the general symptoms only are present; (4) the oculo-glandular variety of which Parinaud's conjunctivitis would be a good description. A mortality of 3 per cent. is given.

Grandström describes a case of the oculo-glandular variety. The agglutination reaction for tularaemia was positive; the patient seems to have been infected by a hare prepared for food. The patient's wife and the shopkeeper developed generalized tularaemia and papillary growths on the hand. The author agrees with Pascheff in speaking of Parinaud's syndrome rather than disease as many cases are probably oculo-glandular tularaemia.

Junius gives a comprehensive survey of the literature of the relationship of the two affections.

ARNOLD SORSBY.

(9) **Barletta (Catania).—The changes in the chiasma and optic nerves in beri-beri in pigeons. (Chiasma e nervi ottici nel beri-beri.)** *Rass. Ital. d'Ottal.*, March-April, 1932.

(9) It is easy to produce beri-beri in pigeons by feeding with cleaned rice; when the disease has appeared, it can be easily repelled by suitable feeding; the alternation of health and disease may be repeated many times without any serious permanent injury. It is only to be expected, therefore, that the histological changes are slight and temporary.

The axis cylinders of the chiasma and optic nerves show tortuosities, varicosities, and swellings, but these are found also in the normal birds; in the diseased birds the myelin sheaths show many more interruptions than do the sheaths of the controls. **Barletta** concludes that these changes are not permanent, but disappear when the disease regresses.

HAROLD GRIMSDALE.

(10) **Baquis (Florence).—Photopsia and visual hallucinations persisting after the removal of both eyes. (Fotopsia ed allucinazioni visive negli individui privi di ambedue gli occhi).** *Lett. Oftal.*, June, 1932.

(10) **Baquis** reports the case of a patient whose eyes were both removed; he was much troubled by visual spectra and complained that since he was blind he had never known darkness. He holds that there is evidence to show that stimulation of the optic nerve after removal of the eye cannot give rise to sensations of vision; these spectra, therefore, must be of cerebral origin.

HAROLD GRIMSDALE.

BOOK NOTICES

Allergy and Immunity in Ophthalmology. By ALLAN C. WOODS, M.D. Pp. 162. Baltimore: The Johns Hopkins Press. 1933. Price 13/-.

Although allergy to certain foods is an old conception and as long ago as the first century Lucretius wrote: "What is food to one man may be fierce poison to others," yet, it is still a new conception as the underlying cause of certain phenomena in disease. It is the author's object in this book to present a digest of the present knowledge and theories concerning it. The word allergy was originally defined as "the changed reaction capacity which animals or man may gain through recovery from disease or treatment with foreign substance," and is now used to denote any form of hypersensitiveness not falling under the strict definition of anaphylaxis. The production of allergic phenomena may be specific to certain micro-organisms in a given patient, yet there seems to be a common fundamental cause for the cell injury which occurs. This may be the production by the antigen antibody reaction of a non-specific histamine-like substance which acts as a poison. The author is careful to state, however, that this is only an hypothesis and that we have as yet no definite knowledge of the exact nature of such a phenomenon. In the first two chapters of his book he gives an interesting account of the work which has been done on this subject and its bearing on disease. The remaining chapters deal with the relations of allergy to focal reactions in the eye, to conjunctivitis, syphilis and tuberculosis. There is a chapter on the antigenic properties of lens protein and uveal pigment and the book concludes with one on therapeutic procedures such as milk injections and inoculations of vaccine. The theoretical bases for these are explored by the author, but as yet, no really satisfactory explanation seems to be forthcoming. In spite of this, however, "Allergy and Immunity" should prove a profitable book for the ophthalmologist to read. The literature on the subject is enormous and quite beyond the scope of the ordinary reader, whereas in the book under review, it is condensed into 166 pages. The author states in his preface that "the effort has been made . . . to present the conflicting views, and at times to evaluate the present status of debated subjects." The first part of this task he has admirably performed, but one could wish that he had placed more emphasis upon the second part, since by not doing so, his book becomes rather impersonal and lacks that touch of individuality which would make it more valuable. What the reader of a book of this kind wants is not so much a collection of varied and sometimes contradictory data and theories, as a solid expression of the author's opinion on them.

CORRESPONDENCE

"WHITE RINGS IN THE CORNEA"

To the Editors of THE BRITISH JOURNAL OF OPHTHALMOLOGY.

DEAR SIRS,—Dr. Harry S. Gradle of Chicago, has called my attention to a short paper, contributed by him to the *Amer. Jl. of Ophthal.*, Vol. VIII, No. 6, June, 1925, in which he recorded having seen within three years more than twenty-five cases presenting a small white ring in the cornea. From his description it would appear that the "ring" had very much the same characters as those referred to in my recent paper, but in Gradle's cases the "ring" had disappeared spontaneously within one to three days. The lack of any complaint of pain or discomfort seemed to eliminate ulceration or a foreign body as the cause.

It will be interesting to discover from further observations whether there are two groups of cases in which the lesions are similar, but in one case transient, and in the other permanent.

Yours faithfully,

A. J. BALLANTYNE.

GLASGOW,
July 10, 1933.

OBITUARY

E. COLLIER GREEN

WE regret to record the death, on July 30, of Mr. Collier Green, senior ophthalmic surgeon to the Derbyshire Royal Infirmary. The son of a Yorkshire clergyman, he was born in 1858 and was trained as an architect; but as this vocation did not appeal to him he entered at St. Thomas's Hospital. Qualifying M.R.C.S. in 1881 he took an assistant house surgeon's post at Derby in the following year. After having served as house surgeon until 1887, he worked for a year at Moorfields, and in 1888 became surgeon to the newly instituted ophthalmic department at Derby.

Collier Green was a much respected and highly popular consultant in the Midlands, and held for some years the post of ophthalmic surgeon to the Burton-on-Trent Infirmary.

As a young man he was a keen mountaineer and he was well known as an amateur photographer of the first class; in this respect

we may mention that his photographic skill was made use of by Mr. Treacher Collins, many of whose publications were enriched by his microphotographs. A charming companion, he will be much missed.

NOTES

Honours

IN connexion with the recent meeting of the British Medical Association in Dublin, an honorary fellowship of the Royal Academy of Medicine in Ireland was conferred on Mr. Bishop Harman, and on Dr. C. O. Hawthorne; while Dr. Gordon Holmes received the Sc.D. of Trinity College.

* * * *

Middlemore Prize for 1932

THIS prize has been awarded to Mr. B. W. Rycroft.

* * * *

Turberville's Eye Lotion

THE following account of an eye lotion attributed to Turberville of Salisbury is taken, by permission of the Council of the Thoroton Society, to which body the book belongs, from the note book of Robert Marsden, Archdeacon of Nottingham (1716-1748) and Prebendary of Southwell Minster (1713-1748). Robert Marsden was of Jesus College, Cambridge, and died in August, 1748, *aet.* 90.

Dr. Turbervill's Eye-water. Dec., 1724. From A.B.C.

Two ounces of white Copperas, half an ounce of Camphire, 2 ounces of Bole-armoniac: Take a little earthen-pot, break ye Camphire small and lay it at the bottom of the pot: then break ye Copperas and lay over it: Set it over a gentle fire, with a paper to cover it: when it has done hissing take it off the fire: Beat it in a mortar with the Bole-armoniac, and sift it fine. Put one ounce of this powder into a bottle: then take a quart of Spring-water well warmed, and fill up the bottle: cork it, and shake it well together, and set it by ye fire 24 hours to keep it worm, in which time shake it often well together. Turn the bottle upside down to make the powder come from the bottom of it.

This water will keep—7—years. When the first water is spent, you may worm more water and keep upon ye powder.

The fire must be slow, not above a coal at a time, for fear of burning ye ingredients to ye bottom of ye pot: a Gally-pot is best

to do it in. When you pour a little into a small bottle for use, be sure to strain it clear throu' a fine linen clooth.

The eye must be washed often in a day with it: let a little go into it. When you use it, you must dip a small soft linen clooth into it, and draw it over your eye-lids, the eye shut. You may let a little of ye water go into the eye, but not (too) much, (unless they be very bad) and keep still in a moderate light, till the whole is dryed up on ye eye-lids. I believe this water is one of the best medicines for rheum in ye eyes.

It is good for Rheumatic-eyes, and a king's evil-humour.

The rect. is communicated to me as a great curiosity: and I chuse rather to give ye water to my Friends, than ye way of preparing it.

This water I make make (*sic*) use of my self: it was ordered by our late eminent Oculist Dr. Turkevilet (*sic*) to ye Bp. of Rochester, (Bp. Sprat)* who for many years could not live without it. When the doctor died, the Bishop bought the receipt of his sister, which I now send you.

*(From Le Neve's *Fasti ecclesie Anglicane*.)—Thomas Spratt, S.T.P., Dean of Westminster, was consecrated Bishop of Rochester 2 Nov., 1684. Died *aet.* 77, 20 May, 1713, at Bromley, buried in Westminster Abbey.

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French Cours de Chirurgie Oculaire

THE usual autumn post-graduate course in ophthalmic surgery will be given by Professor Terrien and his assistants in the ophthalmological clinic of the Hôtel Dieu, Paris.

The course begins on October 20, and is composed of 12 sittings under the following headings: General evolutions and recent procedures; cataract; high frequency in ophthalmology: operations for hypertonus; treatment of detachment of the retina; operations on muscles and lacrymal passages; plastic work; radium therapy; operations for ptosis; ectropion and entropion; and orbital operations. The price for the course has been fixed at 300 francs. A certificate will be given to each pupil at the end of the course. Further information can be obtained from Professor Terrien.

FUTURE ARRANGEMENTS

1933

October 6.—Midland Ophthalmological Society, Annual Meeting, at Birmingham and Midland Eye Hospital.

December 5.—Midland Ophthalmological Society, at Birmingham and Midland Eye Hospital.

CONTEMPORARY OPHTHALMIC LITERATURE

American Journal of Ophthalmology. *July, 1933.*

DUNNAVAN and MOTTO. Kayser-Fleischer ring in Wilson's disease.
FERREE, RAND and MONROE. Critical values for the limits of the colour fields in eight principal meridional quadrants taken separately.
VERHOEFF. An improved and a new test for stereoscopic vision.
CORDES and HORNER. Hysteric amblyopia.
CHANCE. Intra-capsular extraction of the crystalline lens containing a foreign body.
JACKSON. The cross cylinder.
GREEN and BEISBARTH. Extraction of congenital and young adult cataract by the method of Barkan.
CLARK. The ocular disturbances in epidemic encephalitis.
GRESSER. Studies of retinopathies.

Archives of Ophthalmology. *July, 1933.*

THYGESON. Rôle of bacterium granulosis in trachoma.
KNAPP. Intra-capsular operation for cataract. Report on a 4th hundred successive extractions.
ADLER. Is the aqueous humour a dialysate?
THORSON. Myopia in alkalosis from Sippy treatment.
KIRBY and VON WIENER. Carbohydrate tolerance in elderly patients with cataract: Study II.
——— Changes in the concentration of dextrose in human aqueous humour and blood: Study III.
KIRBY, ESTEY and VON WIENER. Effect of changes in medium on cultures of lens epithelium: Study IV.
KRAUSE. Nature of the melanin of the eye.
MACMILLAN and CONE. Solitary neurofibroma of the orbit.
PASCAL. The Ioskiascopy test—simplified.
GUIBOR. Simple evisceration of the globe versus simple enucleation.
GOLDSTEIN and WEXLER. Embolism of the central retinal and ciliary arteries in a case of chronic lipoid nephrosis with thrombosis of the innominate artery.
GOLDSTEIN and GIVNER. Calcified hyaline deposits (Drusen) in the optic disc associated with pigmentary changes in the retina.
FINKELMAN and MAYER. Metastatic carcinoma of the eye and brain.
REDWAY. The antiquity of the forms of the transparent media of the eye: Modifications of the light train.

Annales d'Oculistique. *June, 1933.*

TERSON. Glasses with opaque segments, employed as palliatives and for diagnosis.
DUPUY-DUTEMPS. Adaptation of the aphakic eye for near vision by the removal of the correcting lens for distance.
POLACK. On Holmgren's method.
JEANDELIZE and BAUDOT. Aspects of torn retina without appreciable detachment. Barrage for the detachment.
GONIN. Preliminary measures for the operative treatment of retinal detachment.

July, 1933.

LAGRANGE. Tuberculous iridocyclitis.
LACROIX. The optic nerve and the arsenical trivalents and pentavalents.
KOUTSEFF. Amaurosis from optochin.
SHOJI and TANABÉ. On the problem of corneal haemorrhage and the glistening corpuscles.

COSMETTATOS. On the pathogenesis of congenital fistulae of the lacrymal sac.
ABRAMOWICZ and DULEVICZ. The fundus of the eye in lupus erythematodes acutus. (Erythema perstans.)
ABRAMOWICZ. Superficial striate coronary lens opacities.

Archives d'Ophtalmologie. *July, 1933.*

VAN LINT. Traumatic episcleral abscess with partial iritis in the vicinity. Pathogenesis of sympathetic ophthalmitis.
PACALIN. Binocular vision of relief.
SIMONIN. Experimental research on the minimum visual acuity of motorists.
BRANBERGEN. Ocular symptoms in spirochaetal haemorrhagic jaundice.

Revue d'Oto-Neuro-Ophtalmologie. *April, 1933.*

REBATTU, MOUNIER-KUHN, DECHAUME, BONNET and COLRAT. Report on cephalic shingles.

May, 1933.

——— Report on cephalic shingles. Part II.

Archiv für Ophthalmologie. *May, 1933.*

SALLMANN and SVEINSSON. About acuteness of vision and fields of vision in retinal detachment cured by operation.
SPITZER. On the question of corneal sensitivity after retinal operation.
SZÉKELY. A study of the growth of epithelial lining inside the eye. (Cyst of anterior chamber).
KOLLER. About secondary phenomena of cavernous sinus thrombosis.
MICHAIL. Concussion cataract.

Klinische Monatsblätter für Augenheilkunde. *July, 1933.*

GOERLITZ. Experiences of the operative treatment of retinal detachment.
FUCHS. On transient ring scotoma after traffic accidents and paracentral scotoma after electric ear test.
VOGT. Extensive researches on the intensity of the visible rays from glass ovens, with remarks on the bleaching significance of these rays in glassblowers' cataract.
THIES. The oculist's interpretation of rare X-ray conditions of the skull.
SCHMIDT. On the streaky form of keratitis superficialis herpetica.
BUSACCA. Anatomical and clinical consideration of haemorrhage between the back of the lens capsule and the anterior vitreous limiting layer; the development of a retro-lenticular cavity.
FRIEDE. On the clinical value of thorough autogenous transplantation of the cornea with flap rotation to 180°.
——— On the necessity of preparatory work for keratoplasty.
TOTH. The investigation of lacrymal puncta and canaliculi with the aid of the slit-lamp
ROESE On injuries of the orbital contents by removal of the endo-nasal part of the ethmoid bone.

Annali di Ottalmologia e Clinica Oculistica. *January, 1933.*

CORRADO. End results of Roentgen therapy for sellar and parasellar tumours.
ZANETTIN. Elective localisation of staphylococci in the eye.
BRACCI-TORSI. Dacryocystitis and pneumococci.
CORRADO. The angiospasm factor in the pathogenesis of retinitis pigmentosa and new mode of therapy.

February, 1933.

MAGGIORE. Experimental contribution to the retinal alterations of the human eye exposed to intense light.
COLAJANNI. Research on the equation of Rayleigh with the anomaloscope of Nagel to ascertain relative Daltonism.
BIFFIS. Alkalescence of the blood in glaucoma.
RUSSO-FRATTASI. Dacryocystorhinostomy or dacryocystectomy in ozoena?

March, 1933.

PUSCARIU and LAZARESCU. Mikulicz's disease.
VELE. Glutination in eye diseases.
RUSSO-FRATTASI. On the clinical and pathological aspects of chronic polysinusitis with orbital complications.

Rassegna Italiana d'Ottalmologia. *March-April, 1933.*

SALA. On a case of diffuse papillomatosis of the conjunctival sac.
VELE. Contribution to the study of ocular lesions of acquired syphilis.
LUMBROSO. Fibro-haemangioma of the caruncle.
BUSSOLA. Haematological and capillary researches on trachoma.
BUSACCA. On acute dacryoadenitis.
D'ASARO BIONDO. Ocular lesions from tar derived from carbon.
GIANI. Contribution to the study of anatomico-pathological alterations of the bulbar conjunctiva subjected to trachoma with corneal pannus.
GALLENGA. Observations on the light sense in high mountains.

Revista de Ophtalmologia. *June, 1933.*

MATTOS. Coloured photograph of normal and pathological fundus of the eye.
REZENDE. A modern surgical operation for retinal detachment.

Revista Oto-Neuro-Oftalmologica. *May, 1933.*

PAVIA. A case of tuberculous irido-cyclitis treated with tuberculin, improvement and maintenance of improvement after nine years.

Archivos de Oftalmologia Hispano-Americanos.

LÓPEZ ENRIQUEZ. Rhabdomyoma of the eyelid.
MENDOZA. Physiological optical errors.

Revista Cubana de Oto-Neuro-Oftalmiatria.

AVALOS. Primary tuberculosis of the conjunctiva.
CEPERO and COMAS. Our apparatus for ophthalmic diathermy.
LLAMAS. Gonococcal ophthalmia and fever therapy.
DE PERALTA. Ophthalmic Jaquecoso syndrome, of one year's duration, from unknown chronic nephritis with sudden death from typical uraemic eclampsia.